

Mining

CONGRESS JOURNAL



NOVEMBER
1956

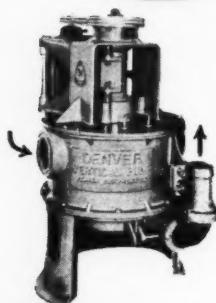


AMC MINING SHOW REPORT NUMBER

DENVER CAN SUPPLY COMPLETE EQUIPMENT FOR YOUR MILL

One Responsibility

Crushers, Screens, Feeders, Ball-Rod Mills, Classifiers, Jigs, Pumps, Samplers, Agitators, Conditioners, Flotation, Thickeners, Filters, Dryers, Ore Testing and Mill Design Services.



DENVER VERTICAL CENTRIFUGAL SAND PUMP . . . for use where

1. Feed is intermittent.
2. Pulp is frothy or air laden.
3. Feed varies in density.
4. Floor space is limited.
5. Plant portability is an advantage.
6. Long life is factor.
7. Initial cost must be minimum.
8. Feed sump is impractical.

Sizes from $\frac{3}{8}$ " to 4". Also Denver Adjustable Stroke Diaphragm Pumps from 2" to 8", simplex and multiple units.

For complete information, WRITE FOR BULLETIN NO. P10-B5.



How DENVER SRL (Soft Rubber Lined) PUMPS CAN CUT YOUR PUMPING COSTS...for abrasive pulps or tailings

1. POWER COSTS CUT

Denver SRL Pumps often use less than one-half the brake horsepower required by other pumps in similar service. This is the result of simplified design and high efficiency of molded rubber parts. This means substantial savings for you in power costs and maintenance.

2. SHUTDOWN TIME REDUCED

Because molded rubber parts are highly resistant to corrosion and abrasion, case history records show where Denver SRL parts lasted up to 15 times longer than parts on pumps previously on the same service. This means increased production, savings for you in maintenance costs—and, more important, reduced down time.

3. A PUMP FOR EVERY JOB

Denver SRL Rubber Lined Pumps are available to you for standard or heavy duty service and with capacities up to 2400 g.p.m. You can choose exactly the right pump that will do your pumping job most efficiently, most economically. Parts for all sizes are kept in stock for fast service. If you have abrasive or corrosive material to pump, you can make substantial savings by using Denver SRL Rubber Lined Pumps. For complete information about what Denver SRL pumps can do for you, WRITE TODAY FOR FREE BULLETIN P9-B8. MOST SIZES OF SRL PUMPS IN DENVER STOCK.

"The firm that makes its friends happier, healthier and wealthier"

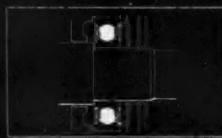


DENVER EQUIPMENT CO.

1400 Seventeenth St. • Denver 17, Colorado
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MEXICO, D. F. • LONDON • JOHANNESBURG

Don't overlook what you can't see

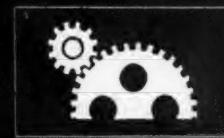
You can't always see what makes a gearmotor outstanding. It's the attention paid to small design details that makes the difference. Here are a few of the details that make the new Reliance Gearmotor stand above the rest.



FOOLPROOF METERMATIC
motor bearing lubrication and oil bath gear lubrication for long-life protection against wear.



INDUCTION HARDENING of the tough alloy steel gears gives a perfect combination of wear resistance and strength.



SIMPLIFIED GEARING with few moving parts reduces friction losses and lessens chances of breakdown.



THRUST BEARINGS handle heavy overhung loads safely by placing strain on the frame instead of the shafts.

Find out the complete story for yourself—contact your Reliance representative or write for Bulletin E-2408.

E-1009

RELIANCE ELECTRIC AND
ENGINEERING CO.

CLEVELAND 10, OHIO · OFFICES IN PRINCIPAL CITIES

Canadian Division: Welland, Ontario

REDUCE
SPEED



1

Scene: Hoffman Bros. & Wilson Quarry, Harrisburg, Pa. Blast using Atlas AMOCORE with Giant Gelatin primer, is initiated at bottom of holes. Propagation excellent, despite water in holes.

*Lower your blasting costs
gain better digging*

Get sure-shots like this



2

37 ft. quarry face erupts in well controlled heave, with minimum noise and vibration.



3 Well formed muck pile—9,661 tons of limestone rock—is ready for easy digging.

with AMOCORE

No matter how low cost a blasting agent may be, its economy can only be measured by effectiveness of the blast.

Dependable Atlas AMOCORE, an economical blasting agent of ammonium nitrate and carbonaceous material, affords true savings far beyond its low price. Properly used with ROCKMASTER® blasting methods, AMOCORE provides sure shots with maximum breakage, well controlled throw, minimum noise and vibration.

Its continuous gelatin core assures a better order of detonation through any length column—initiation at bottom or any point you choose. The convenient fluted-end cartridges permit easy loading in both horizontal and vertical holes.

AMOCORE is available in high, medium or low velocity. It is one of a complete line of Atlas Explosives and Blasting Agents. Get full details from your Atlas representative. And write for "Better Blasting," Atlas' informative newsletter on latest methods and materials.

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ATLAS
POWDER COMPANY
WILMINGTON 99, DELAWARE
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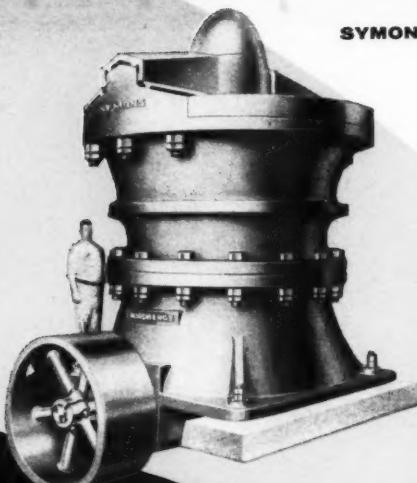
NORDBERG MACHINERY
for URANIUM PRODUCTION
keeps pace with the Atomic Age

URANIUM—the Wonder Metal of the Atomic Age—is today one of the most sought after elements in the earth's crust. And with good reason when you consider that one pound of pure Uranium will produce by fission as much energy as the combustion of 20,000,000 pounds of coal. This powerful new servant serves mankind in many ways and each day its benefits grow increasingly greater.

Increasing too is the role being played by Nordberg Machinery in the efficient processing required for production of this valuable metal. From the Congo and South Africa to the ore bodies of the United States and Canada, leading producers are installing Symons Gyratory Crushers for primary breaking, Symons Cone Crushers for finer reduction, Symons Grizzlies and Screens for scalping and sizing, and Nordberg engines for mine and mill power.

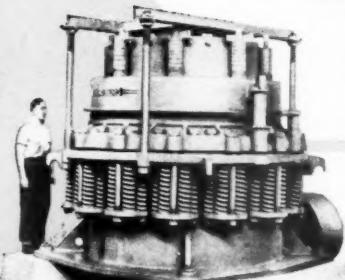
SYMONS® PRIMARY GYRATORY CRUSHERS

Built in 30", 42", 54", 60" and 72" sizes, for capacities up to 3500 or more tons per hour.



SYMONS CONE CRUSHERS

Built in both Standard and Short Head types, in sizes from 22" to 7', in capacities from 6 to 900 or more tons per hour.



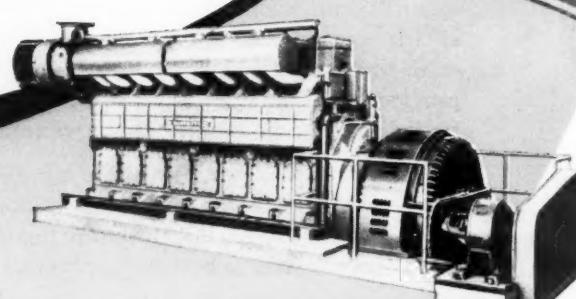
SYMONS VIBRATING BAR GRIZZLIES

Built for heavy duty large capacity scalping service. Particularly effective when handling wet, sticky or gummy ores. Will handle feeds up to 30" and larger.



SYMONS ROD DECK SCREENS

Highly efficient, big capacity units adaptable to mill feed screening and for handling heavy feeds of wet, sticky ores.



NORDBERG ENGINES

Built in a wide range of sizes from 10 to over 12,000 horsepower, including Diesel, Duafuel® and Spark-Ignition Gas types for low cost power generation.

Write for information
 on your machinery requirements.

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C-454

NORDBERG MFG. CO.
 Milwaukee, Wisconsin

SYMONS . . . A Registered Nordberg
 Trademark known throughout the world.



NORDBERG



MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS
 NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
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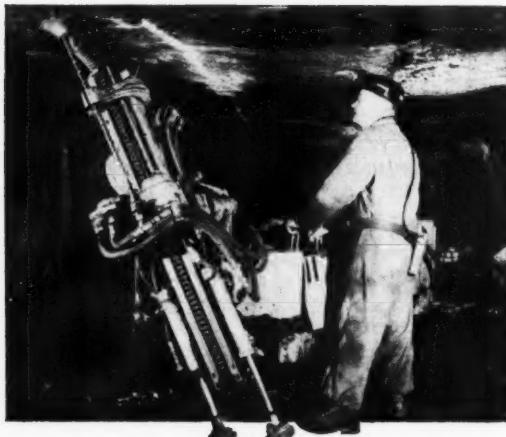
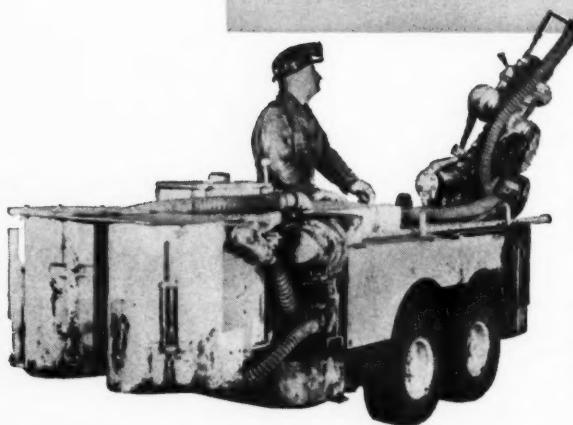
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JOY RBD-15

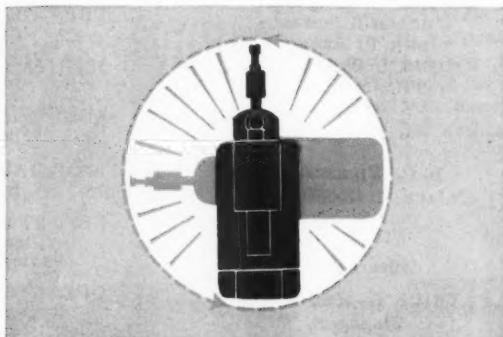
ROTARY ROOF BOLTING DRILL FOR SHALE, SLATE, OR SANDSTONE ROOF



Simple controls, centralized at the operator's station, provide instant control of thrust, feed-speed and torque and drilling angle. Drills, runs steel and sets bolt without gear shifting.

The Joy RBD-15 is a hydraulic rotary drill designed to bottom holes in 65% of all U. S. coal mines in often half the time required by pneumatic or electric drills. A central hydraulic system coupled directly to a 15 hp electric motor powers tramping, steering, drill rotation, drill feed and boom roll.

The RBD-15 operates in seams from 42" to 96" high. One basic frame and chassis is offered in two heights; the 33" model for low and medium-low seams, and the 37" model for high seams, or for medium seams requiring high ground clearance.



HIGHLY MANEUVERABLE

The RBD-15 is fast and flexible . . . trams up to 108 fpm. Individually controlled pairs of wheels on each side can be powered independently . . . forward on one side—reverse on the other . . . the machine turns in its own length (dimensions 33" x 42" x 9' 6") like a crawler mounted unit.

TWIN BOOM MODEL

The RBD-11 has twin booms with RDU-1 drill units. Each boom swings 90° out and 25° in to provide a 23 foot face drilling range . . . has 240° roll and 30° tilt . . . can be individually controlled. The RBD-11 is an all-hydraulic machine, 43" high, 82" wide and 22' long, equipped with a 26 hp electric motor, and a four section hydraulic pump. The RBD-8 is a single boom version of the RBD-11, available with either electric or diesel power.

The RBD-7 is an unmounted boom and drill unit to be mounted on a mine car or shuttle car.



DRILLS AT ANY ANGLE GETS IN ANYWHERE

(TURNS IN ITS OWN LENGTH)

The two sketches at upper right illustrate the action of the hydraulic boom roll and the easy manual tilt that makes it possible for the RBD-15 to drill at any angle. The boom roll also allows the operator to change steel without moving the machine. The drill unit consists of a two-speed rotation unit, a two-speed feed unit, steel centralizer and two foot jacks . . . all mounted on a rigid feed frame.

Two hydraulic rotation motors allow the operator to choose rotation speed and torque . . . 650 rpm for high speed drilling . . . low speed up to 360 rpm with torque up to 240 ft. lbs. for tightening bolts or harder drilling.

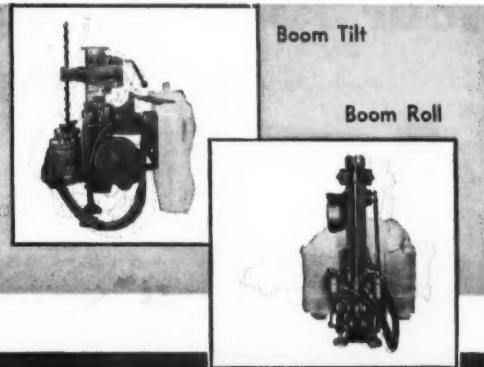
Feed thrusts can be varied up to 5500 psi . . . feed speeds up to 12 fpm, with "run-up" and retraction speeds up to 60 fpm. Write **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

Write for FREE Bulletin 134-3



"SPECIAL ROOF-TESTING SERVICE"

A special laboratory method of testing rock samples can show you what to expect with your roof conditions. Samples are shown below. Joy will run these tests for you.



WSW CL 6347-134

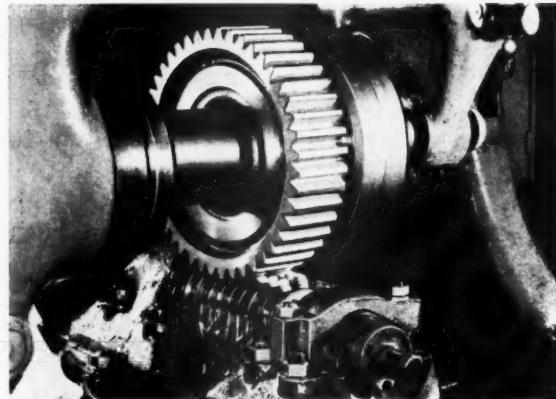


Your Allis-Chalmers equipment deserves True Original Parts

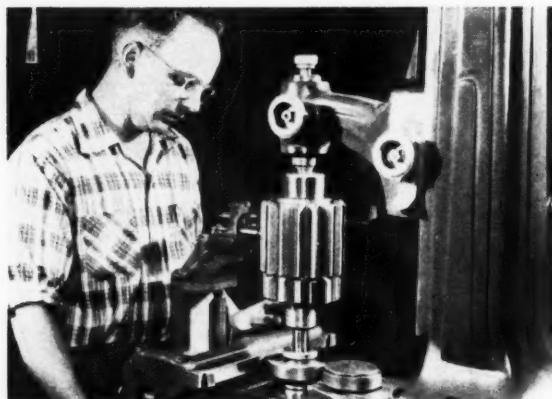
Why? Because they meet design, manufacturing, inspection and packaging standards that assure long life . . . budget-stretching low-cost operation.



DESIGNED WITH THE ORIGINAL EQUIPMENT. Each Allis-Chalmers True Original Part benefits from a fine metallurgical research program. Each is designed by experienced engineers to do its full share of the work . . . just as each component in your Allis-Chalmers machines did when this equipment was new.



PRODUCED ON MODERN MACHINES BY SKILLED CRAFTSMEN. Here's where modern manufacturing equipment and know-how combine to produce precision parts. This combination is the reason you can be sure of getting full work power from any Allis-Chalmers equipment in which True Original Parts are used.



CAREFULLY INSPECTED FOR PRECISION FIT. Every Allis-Chalmers part goes through rigid original-equipment inspection processes and testing routines. Gears are checked many times — for perfect meshing, true balance, full capacity.



PROPERLY PACKAGED FOR LASTING PROTECTION. Many are specially treated to protect against rust and dust. Others are safety-packed to guard against nicks, scratches or handling damage.

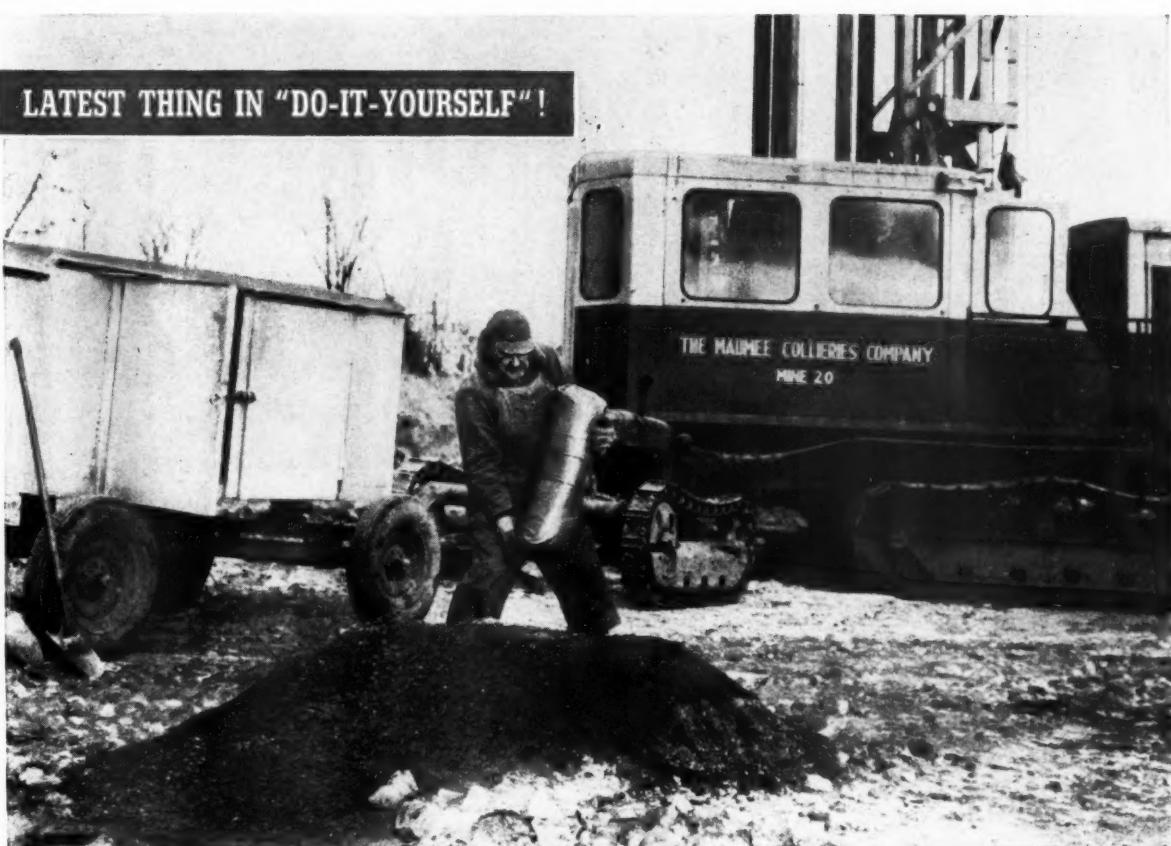
True Original Parts are available at your Allis-Chalmers Construction Machinery dealer—where factory-trained servicemen are on hand to help you at all times.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS



LATEST THING IN "DO-IT-YOURSELF"!



Developed by Maumee Collieries Co., Terre Haute, Ind.—Akremite offers high energy at extremely low cost—a combination that's hard to beat!

The Akremite* Blasting Method! (for large-diameter blast holes)

Large operators should consider this "do-it-yourself" plan. It's a sublicensing arrangement for producing and using Akremite blasting agent.

Maximum safety, fast handling, rock-bottom cost

Here's why you'll profit: designed for dry, large-diameter holes in medium-hard material—strip-pit, open-pit or quarry shooting—Akremite's combination of safety, work and cost advantages offers a lot for a little. It cannot be detonated by caps, friction, shock or Primacord—but relatively insensitive Nitramite® primers or properly sized dynamite primers do the job. Loading's fast because Akremite plastic bags are easy to handle and ex-

pand to fill the hole. Non-headache-producing—high energy—amazingly low cost.

Write for complete details

So if you're looking to increase safety and save money—investigate the use of Akremite NOW. You can make it yourself by a simple process, as many large coal strippers are doing. Or, if you prefer, you can buy Akremite direct from DuPont. Write us for complete details, or contact any of the companies listed at lower left. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.



Licensed exclusively to the Du Pont Company under the Maumee Collieries Co. Process Patent No. 2,703,528 and presently sublicensed to . . .

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PACIFIC POWDER COMPANY
TROJAN POWDER COMPANY

AKREMITE BLASTING METHOD

LICENSED TO



REG. U. S. PAT. OFF.

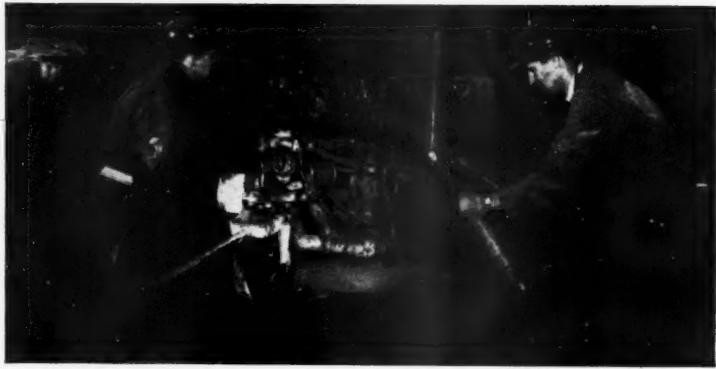
BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

CP roof bolting unit increases tonnage 25%

When a West Virginia coal company reached bad roof at their low seam mine, they found that timbering lowered headroom to such an extent that equipment had to be moved at a slow pace to avoid dislodging crossbars. Soon after wood timbering was replaced with 30-inch expansion type bolts, bored and set by a RBD-30 Roof Bolting Unit, daily production jumped 70 tons per shift . . . an increase of 25%.

And the CP mobile Roof Bolting Unit takes less

than 3 minutes to complete an entire roof bolting cycle! Where hole depth is less than 36" it's even faster . . . can complete the cycle in 1½ minutes flat. One motor drives both auger and bolt setter . . . the versatile chuck telescopes 6 inches to conform to roof variations. The RBD-30 is available with water swivel attachment; special low speed spindle adapter for slow speed drilling and a low seam drilling attachment for low coal areas.



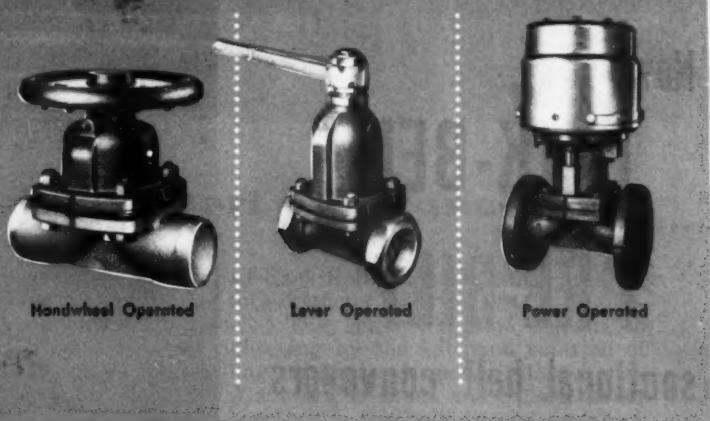
Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

ALL-PURPOSE VALVE

for handling materials as diversified as corrosive fluids, gases, beverages, viscous materials, foods, compressed air, solids in suspension.



Grinnell-Saunders Diaphragm Valve

Unsurpassed on lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

In industries as varied as mining, food, textile, pulp and paper, beverage, water and sewage, chemicals . . . Grinnell-Saunders Diaphragm Valves continue to win enthusiastic acceptance. The unique design of the valve — with its flexible, long-wearing, tight-closing diaphragm — offers many unusual advantages. If you have a valve problem, it will pay you to write Grinnell for further information.

GRINNELL
WHENEVER PIPING IS INVOLVED

Choice of Materials

Bodies — iron; cast steel; stainless steel; Durimet 20; Hastelloy A, B, C; bronze; Monel; aluminum; PVC (polyvinyl chloride); Saran

Body linings — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

Diaphragms — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

Bonnets — iron; stainless steel; bronze; other materials on special order

Choice of Bodies

Conventional weir type

Straight bodies — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

Angle bodies — screwed; flanged; socket weld

Other types

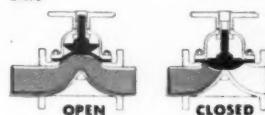
A line of Straightway Valves (for straight-thru flow) and Full-Bore Valves (for ball brush cleaning) also are available

Choice of Bonnets

Handwheel (non-indicating stem, indicating stem); chain wheel; lever (for quick operation); sliding stem (for a wide selection of power operated topworks)

Operating Features

- diaphragm absolutely isolates bonnet mechanism from the fluid in the line
- diaphragm lifts high for streamline flow in either direction
- diaphragm presses tight for positive closure
- simple maintenance — diaphragm easily replaced without removing valve body from line



Grinnell Company, Inc., Providence, Rhode Island

• Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermalier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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Now! It's
LINK-BELT
.....
PRE-BILT
sectional belt conveyors
for



Link-Belt conveyors efficiently stock and reclaim four sizes of sand and gravel at one of the industry's most modern yards.

EASY SELECTION... QUICK DELIVERY

Order from nearest of
9 plants—reduce
costs and delays

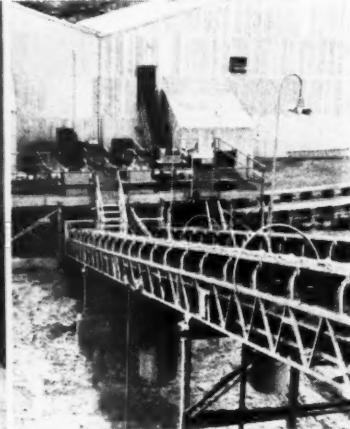
HERE'S today's top answer to efficient, economical, long-life bulk handling—Link-Belt PRE-BILT sectional belt conveyors. They combine standard products, sectional truss frames and supporting bents to meet your exact requirements. Let a Link-Belt representative help you choose from 27 standard, packaged components—with drives up to 40 hp . . . 18, 24, 30 and 36-in. belt widths . . . 24 and 42-in. truss depths. For the full story, call your nearest Link-Belt office.



Book 2579 outlines Link-Belt PRE-BILT sectional belt conveyor advantages. Write for your copy today.



Inclines like this pose no special problems for highly-adaptable Link-Belt PRE-BILT sectional belt conveyors.



Conveyor with 30-in. wide belt handles iron ore concentrate and tailings from washing plant to loading hoppers.

FROM SELECTION TO OPERATION... AS SIMPLE AS THIS

EASY SELECTION. Your Link-Belt representative will help you select the best combination of PRE-BILT sectional belt conveyor components.

PROMPT QUOTATIONS. He will prepare a comprehensive and accurate estimate of requirements for installations that permit "on-the-ground" survey.

SIMPLIFIED PURCHASE. Parts are standardized, interchangeable, all available from one supplier. Link-Belt representative can furnish all necessary data.

QUICK DELIVERY. PRE-BILT conveyors are built at nine strategic locations and are shipped from the plant nearest you.

FAST INSTALLATION. Can be readily handled by your own erectors in most cases. Link-Belt can also furnish complete erection service and supervision.

LINK-BELT
BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

14,113

CF&I ROCK BOLTS

CUT TEMPORARY DRIFT SUPPORT COSTS ONE-THIRD

Climax Molybdenum Company is using CF&I Rock Bolts and Realock® Chain-Link Fabric to save 30-35% on temporary slusher drift support. Developed by the Climax Planning and Mining Departments, the new method:

- Enables miners driving drifts to do their own rock bolting with the same machines used to drive heading.
- Is much faster and more versatile than older methods.
- Has been fully tested for safety.
- Affords proved savings over old methods (35% less than 8" x 8" square sets; 30% less than wedge-type bolts and landing mats).

The CF&I Rock Bolts used by Climax are 7 ft. long $\frac{3}{4}$ inch diameter bolts with Pattin Expansion Shells. They have left-hand threads to allow tightening by the left-hand rotation of the drilling machines. A special adapter consisting of a machine chuck and square socket welded together is the only special accessory needed for this operation.

This is just one of the many jobs being performed by CF&I Rock Bolts—known throughout the mining industry for their dependable performance. Why not get the full details on how you can use CF&I Rock Bolts to advantage in your own mining operations? Just write the nearest sales office listed below.



Here CF&I Rock Bolts and Realock Chain-Link Fabric are being installed for temporary drift support.

Other CF&I Steel Products for the Mining Industry

Cal-Wic Industrial Screens • Wickwire Rope • Grinding Rods • Grinding Balls
Light Rails and Accessories • Realock Chain-Link Fabric



THE COLORADO FUEL AND IRON CORPORATION

DENVER • OAKLAND

3618

Latest addition to the famous line of Timken carbide insert and multi-use bits:

New Timken[®] tapered s

It's removable—

Lets you get full life out of drill steel
—lowers reconditioning costs

It remains secure—

Precision tapered socket gives a
secure union between bit and steel

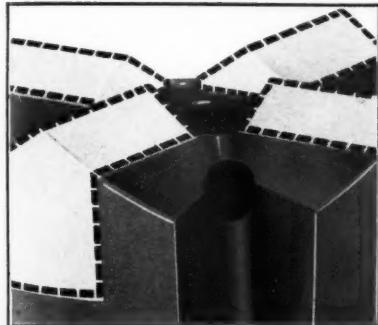
The Timken Company offers its first tapered socket bit in the United States designed for air-leg drills and light stoping. It combines all the advantages of removable bits and carbide insert bits. It has frontal features that speed drilling and chip removal, give you the lowest cost per foot-of-hole. And its uniformly tapered socket provides a secure union, reduces breakage, permits quick bit changes.

With the new Timken[®] removable tapered socket bit you'll get full life from your drill steel, cut your reconditioning costs, and you can change bits faster. And like other Timken carbide insert bits, the Timken tapered bit will hold its gauge longer, drill faster, cut your bit costs on really tough drilling jobs. Special analysis carbides give the Timken tapered bit superior wear-resistance, with added shock-resistance. Adds life to the bit. Other new mechanical features—specifically made to cut drilling costs on air-leg drills and light stoping—include five specially positioned front blowing and washing holes, and new extra clearance between wings for speedier chip removal.

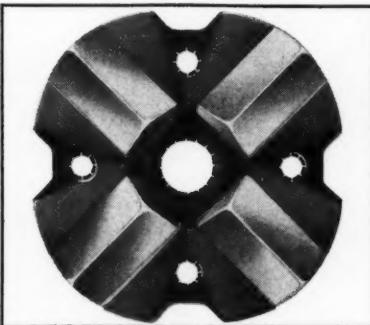
This new Timken tapered bit can be reconditioned many times. And the body is made of special analysis Timken electric furnace fine alloy steel—with the finest physical properties obtainable in a rock bit today. For more details, get your free Timken tapered bit brochure! Write to: The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".



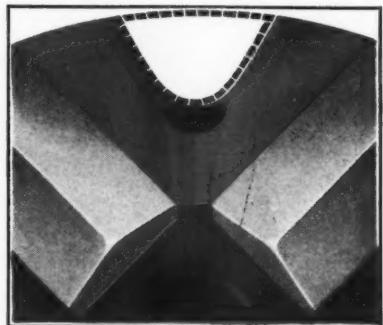
socket bit FOR AIR-LEG DRILLS AND LIGHT STOPING



LONGER BIT LIFE FROM WEAR-RESISTANT CARBIDES: Special analysis long-life carbide inserts give the 4-point "cross" cutting face superior wear-resistance, with added shock-resistance. This new cutting edge adds service life to your bit, *lowers your cost per foot-of-hole.*



JET ACTION FROM 5 FRONT HOLES SPEEDS DRILLING: Positioned to direct water against face with more velocity, wash away chips faster. Larger center hole, with plug dropped deeper for freer cutting action, less drag on bit. New frontal design adds life to bit, *cuts your cost per foot-of-hole.*



FASTER CHIP REMOVAL WITH DEEPER, WIDER CLEARANCE: Extra deep, wide clearance, works in conjunction with five front holes to speedily remove chips from the cutting face. Speeds drilling, makes cutting more efficient, adds life to bit, *helps to lower your cost per foot-of-hole.*

Improved Timken Threaded Carbide Bit for all your other tough drilling jobs

An improved version of the famous Timken threaded carbide bit! Offering deeper, wider clearance between wings—and special analysis carbide inserts for superior wear-resistance—this new Timken threaded bit offers two additional features: new, deeper undercut under the heel, and a new, improved thread contact! The deeper undercut adds life to your bit by improving extra clearance for washed-back

chips and abrading particles—and reduces drag on the bit during drilling. A new redesigned heavier wing also contributes to faster drilling and longer bit life. By adding service life to your bit these newly designed features *lower your drilling cost per foot-of-hole.* For more details, write for your free copy of our newest brochure on Timken Threaded Removable Rock Bits.



TIMKEN REMOVABLE ROCK BITS

TRADE-MARK REG. IN U. S. PAT. OFF.

Your best bet for the best bit for every job... threaded carbide insert, multi-use tapered carbide insert

TOUGH HEAVY DUTY MINING CABLES *that have no equal!*

New SUPERTUF JACKET* makes
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* General Cable's remarkable
Flame Resistant SUPERTUF JACKET
is a new neoprene compound
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strength—extra smooth for wear,
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GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N.Y. Offices and Distribution Centers Coast-to-Coast

Built for Heavy Loads and Hard Knocks



This is a husky 10-ton car, a bulldog that will take a lot of beating. It was designed by Bethlehem, made in the Bethlehem shops—and every inch of it is sound.

Features include all-welded body, cast-steel trucks and roller bearings, forged-steel wheels and axles, automatic couplers, and spring draft gear. The car is intended for rotary-dump service.

We recently delivered an entire fleet of units like this for a large-scale mining operation. The cars were designed, of course, to meet the requirements of that particular coal mine. Perhaps your own needs are altogether different; but whatever they

are, Bethlehem is fully prepared to meet them with either end-dump or rotary-dump models. We can always give you a choice of welded or riveted construction, high- or low-side body styles, and four- or eight-wheel running gear.

Bethlehem engineers will gladly work closely with you on matters of car design and manufacture. When they can be of service, feel perfectly free to consult them. A letter or call will start the ball rolling.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL





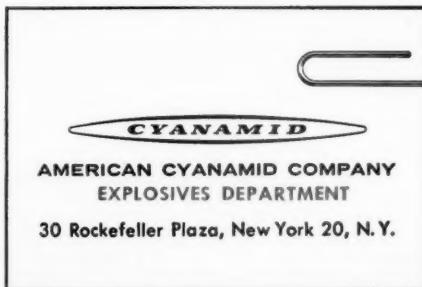
BEHIND THIS SYMBOL

...are many years of valuable experience in meeting the exacting requirements of the coal industry for explosives and detonating equipment. You can rely on AMERICAN for precision performance and efficient cooperation in solving any unusual blasting problems. Fast delivery is assured by conveniently located plants and magazines.

THE AMERICAN LINE

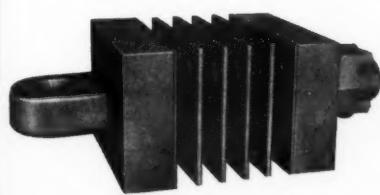
High Explosives	Electric Blasting Caps
Permissibles	Instantaneous
Blasting Powder	Regular Delay
Blasting Caps	Split-Second Delay
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If it's AMERICAN, it's dependable!



Sales Offices: New York City, Latrobe, Pa., Pottsville, Pa., Scranton, Pa., St. Louis, Mo., Bluefield, W. Va.

Still another
large underground mine
equips with
NATIONAL devices



NATIONAL MI-230-5 RUBBER CUSHIONING DEVICES ARE USED BY CANADIAN JOHNS-MANVILLE MINE CARS TO ABSORB VERTICAL AND END TO END SHOCKS.



WILLISON AUTOMATIC COUPLERS COUPLE AT EITHER END OF CAR OR LOCOMOTIVE, REQUIRE NO MANUAL ASSISTANCE.

The Granby-type cars used in the new operations of Canadian Johns-Manville's Matheson, Ontario, mine are being equipped with National devices . . . as are the cars used in the company's Asbestos, Quebec, operation. These two operations are installing Willison Automatic Couplers and National rubber cushioning devices.

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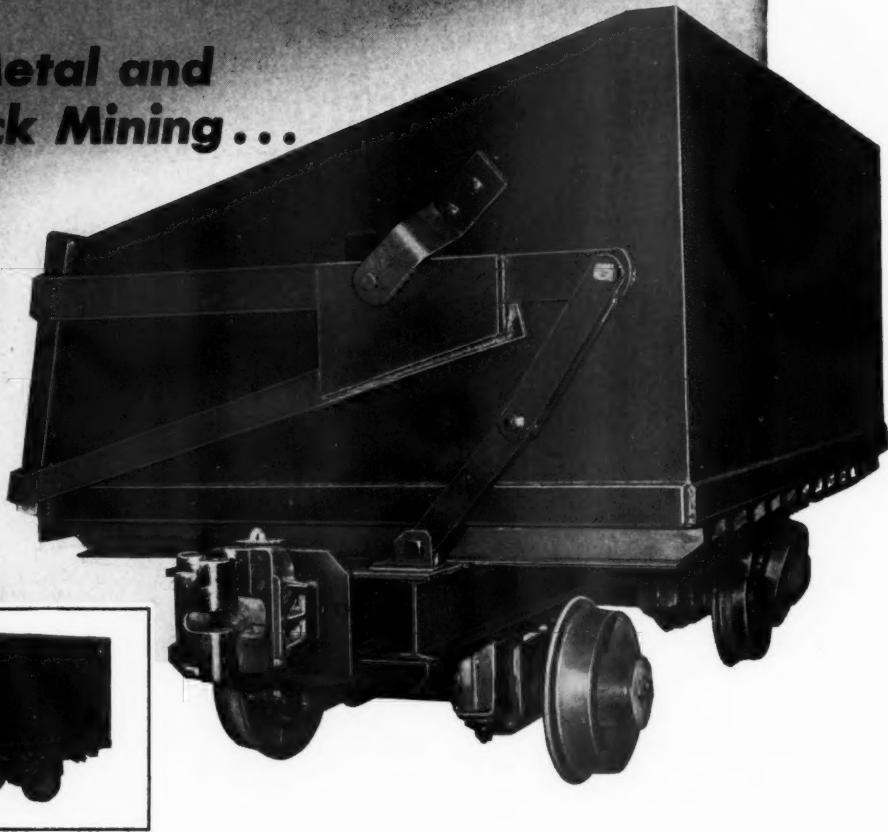
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NATIONAL MALEABLE AND STEEL CASTINGS COMPANY OF CANADA, LTD.
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MINE AND INDUSTRIAL CAR TRUCKS
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The IRWIN GRANBY TYPE CAR

**For Metal and
Rock Mining . . .**



Now from the makers of the famous, time-proven Irwin Mine Cars comes this heavy duty Granby type car. Designed and built especially to successfully withstand the shocks and rough treatment of high-production metal and rock mining.

Weighing 8000 pounds with a capacity of 133 cubic feet, this third rail dumper is strongly reinforced throughout by rugged I beams. Furnished in any capacity for any track gauge.

Cut your haulage costs and reduce maintenance the Irwin way. For further data write Dept. 513, Irwin Foundry and Mine Car Co., Irwin, Pennsylvania.



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Explosives Department
HERCULES POWDER COMPANY

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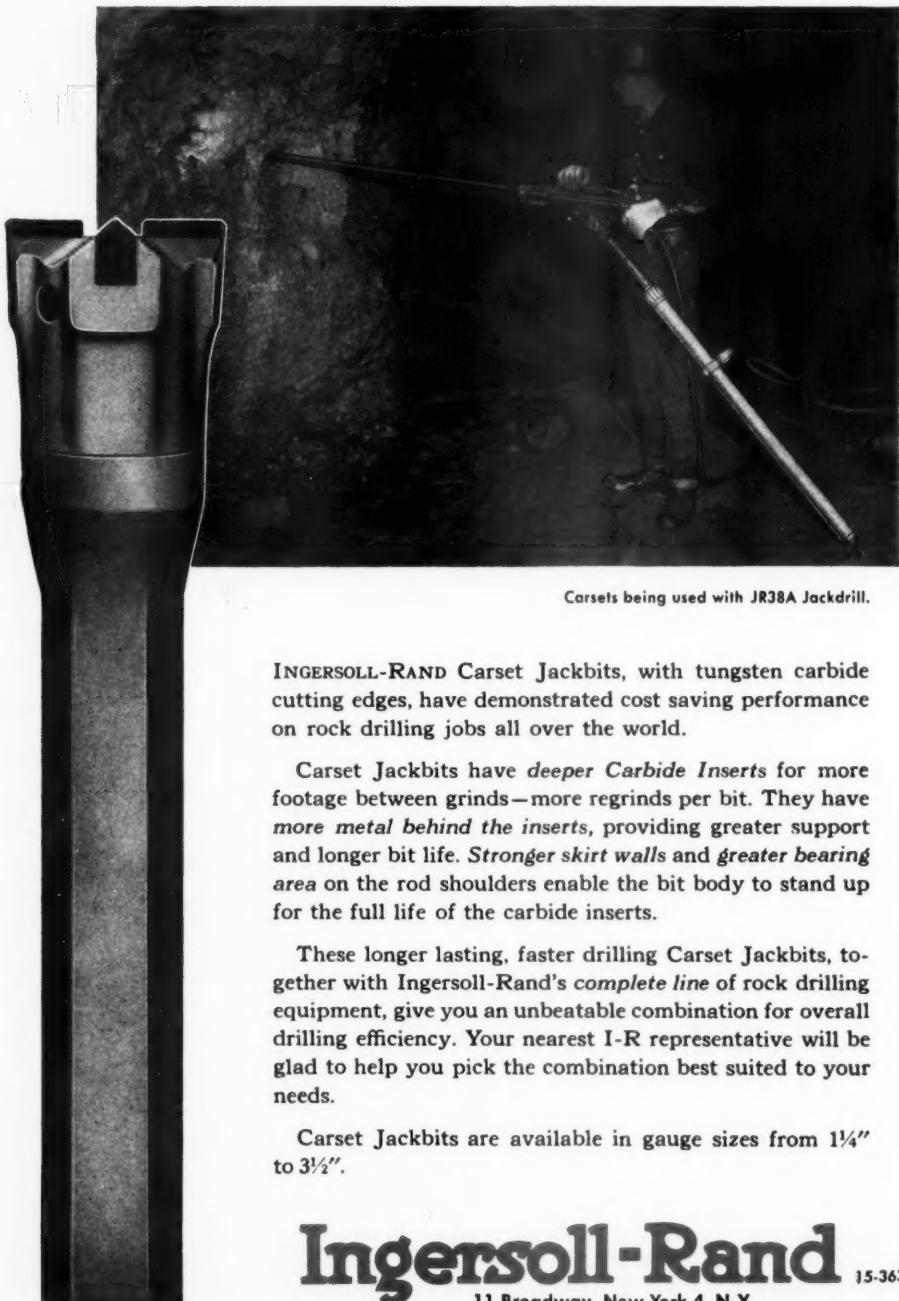
1756-1





Carset Jackbits

DRILL FASTER and LAST LONGER



Carsets being used with JR38A Jackdrill.

INGERSOLL-RAND Carset Jackbits, with tungsten carbide cutting edges, have demonstrated cost saving performance on rock drilling jobs all over the world.

Carset Jackbits have *deeper Carbide Inserts* for more footage between grinds—more regrinds per bit. They have *more metal behind the inserts*, providing greater support and longer bit life. *Stronger skirt walls* and *greater bearing area* on the rod shoulders enable the bit body to stand up for the full life of the carbide inserts.

These longer lasting, faster drilling Carset Jackbits, together with Ingersoll-Rand's *complete line* of rock drilling equipment, give you an unbeatable combination for overall drilling efficiency. Your nearest I-R representative will be glad to help you pick the combination best suited to your needs.

Carset Jackbits are available in gauge sizes from $1\frac{1}{4}$ " to $3\frac{1}{2}$ ".

Ingersoll-Rand 15-363
11 Broadway, New York 4, N.Y.



STANOLITH Grease gives coal a smooth ride

Over 5,000 bearings need just one grease. Never a bearing lubrication failure.

Part of the coal for the Wabash River Generating Station operated by the Public Service Co. of Indiana near Terre Haute, comes directly from the Viking Coal Mine Processing Plant via a conveyor system. The system operates 365 days a year moving up to 4,800 tons of coal per day. STANOLITH Grease has been used to lubricate all bearings in the conveyor system since February 3, 1953, the start up day. In all that time there has never been a bearing lubrication failure.

Prior to the initial operation of the conveyor system, maintenance supervisors checked with Paul Manning, Standard Oil industrial lubrication specialist, about lubricating the new



Quick facts about STANOLITH Grease

- Water resistant
- High temperature resistant
- Pumpable in grease gun or pressure system
- Mechanically stable



STANDARD OIL COMPANY
(Indiana)

Part of coal conveyor system at
Wabash Power Plant, Terre Haute.
Entire conveyor is lubricated with one grease
—STANOLITH. No bearing failures
experienced during the 3½
years conveyor has operated.

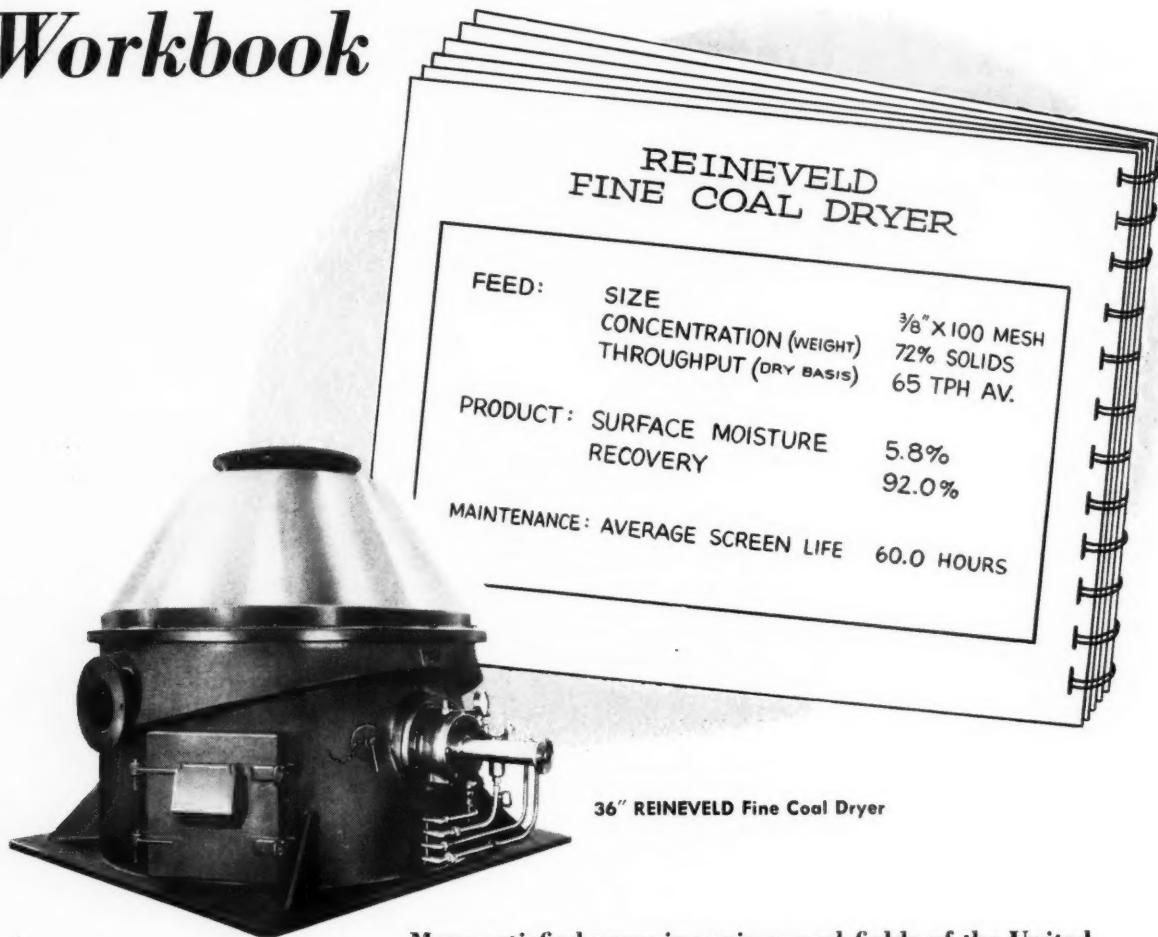
installation. Paul, they knew, has extensive experience (21 years) in handling lubrication problems of this kind. Working with plant management, Paul recommended STANOLITH Grease No. 42 for the job. STANOLITH Grease has fulfilled maximum expectations.

STANOLITH Grease is a smooth textured grease. It is made from highest quality oil, lithium soap and special additives. It resists water washing and water contamination. STANOLITH Grease works well in exposed, outdoor installations. It will not channel. It is chemically stable. It can be applied easily by hand, gun or pressure system.

Find out more about STANOLITH Grease. Talk to your Standard Oil industrial lubrication specialist. There is one near you in any of the 15 Midwest or Rocky Mountain states. Or write 910 South Michigan Avenue, Chicago 80, Illinois.



Out of the Engineer's Workbook

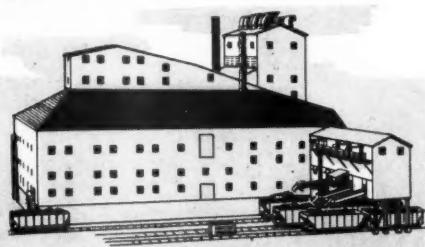


Many satisfied users in various coal fields of the United States testify to the excellence of this centrifugal fine coal dryer. Drying is accomplished swiftly and continuously by high gravity forces imposed on the feed particles by the high-speed spinning motion of the drying elements.

Delivery can be made promptly from the complete line of Reineveld Coal Dryers and parts carried in our Pittsburgh stock.

For an economical and efficient solution of your fine coal dewatering problems, contact your H & P Sales Engineer.

Heyl & Patterson
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PARADE OF PROGRESS

the
story
behind

TIGER BRAND WIRE ROPE



Celebrating our 125th Anniversary

From Hoop Skirts to



The first successful wire making enterprise in America was started in 1831 at Worcester, Massachusetts, and became known as Washburn and Moen. This firm produced wire for the woolen industry, for screws and nails and piano wire.

The first big boom in wire making came through a whim in fashion—the hoop skirt—and Washburn and Moen took full advantage of it. They became the leading wire producer in the nation and won a reputation for quality which they never relinquished.

In 1899, during the era of big mergers, Washburn and Moen, along with many other wire making plants, were incorporated into the American Steel and Wire Company of New Jersey, which soon became a part of the United States Steel Corporation.

A few years later, American Steel & Wire began to manufacture wire rope at Trenton, New Jersey and New Haven, Connecticut. This product was highly successful. Production expanded . . . and today American Steel and Wire is the largest producer of wire rope in the world, making more than 1,000 kinds and sizes.

Your closest contact with wire rope may be a daily ride in an elevator. You see it supporting the biggest suspension bridges, and digging coal on mammoth shovels. It is used on the deepest oil wells, on ships and steel mill cranes, for highway guard rails and logging cables. Wire rope and strand are the universal tools for pulling, hauling and transporting man, his goods and materials. Write for our book on Tiger Brand Wire Rope.

AMERICAN STEEL & WIRE DIVISION,

UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

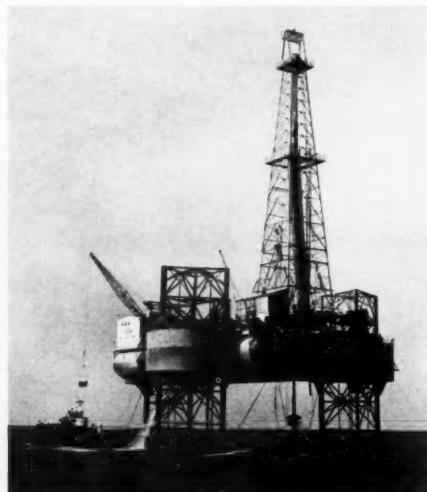
USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed



Wall of Stainless Steel Strand

Tiger Brand in one of Chicago's new parking garages. American Steel & Wire springs provide the 1,000-lb. tension to keep the strand taut.



Drilling for Oil in the Gulf of Mexico with a new type of rig equipped with 5,000 feet of Tiger Brand Drilling Line.



UNITED STATES STEEL

Suspension Bridges

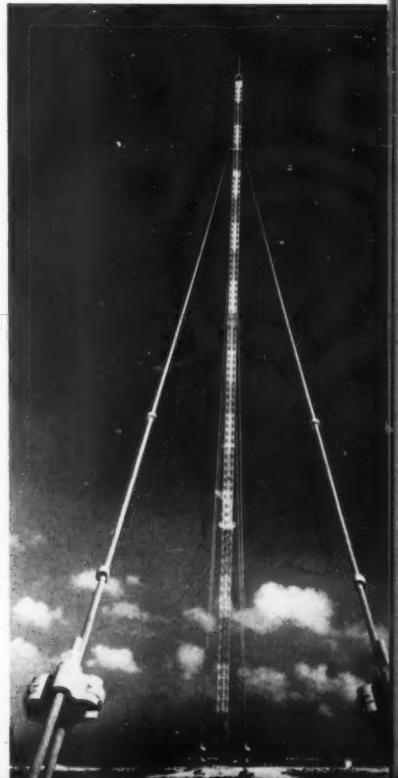


Over 45,000 miles of wire products by American Steel & Wire will be used to complete the Mackinac bridge at St. Ignace, Michigan—longest suspension bridge in the world.



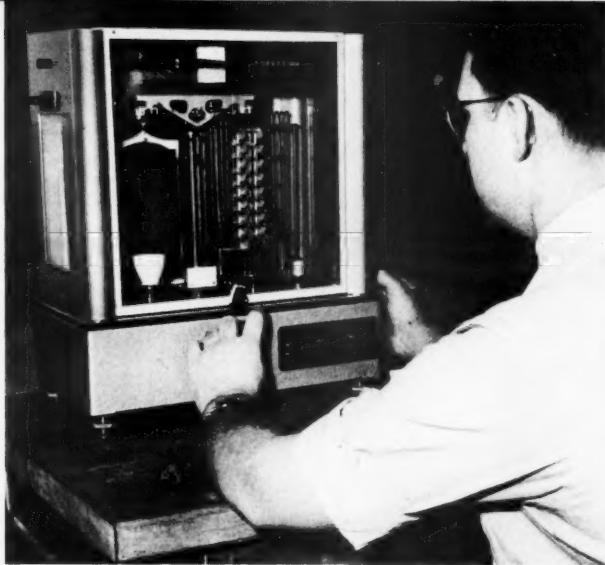
World's Largest Shovel scoops up 60 cubic yards in one bite. Tiger Brand Wire Rope provides the steel "muscles" that make it work.

Tall TV Tower for station WGBS-TV in Miami, Florida, must withstand high winds. It is supported by 1 $\frac{1}{8}$ " Tiger Brand galvanized strand.

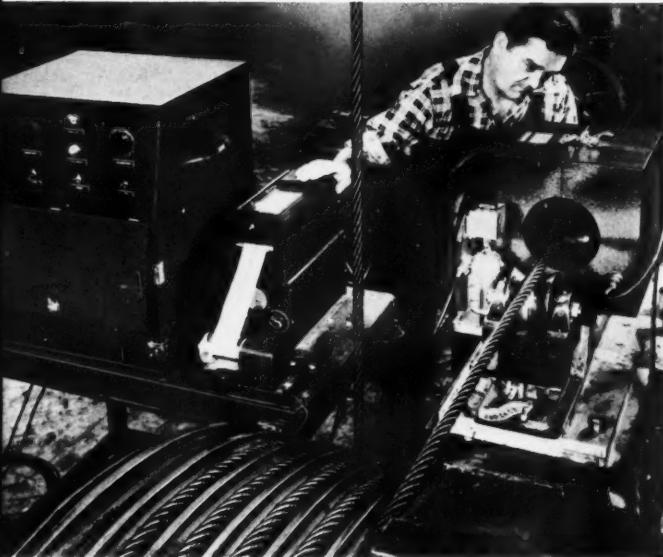




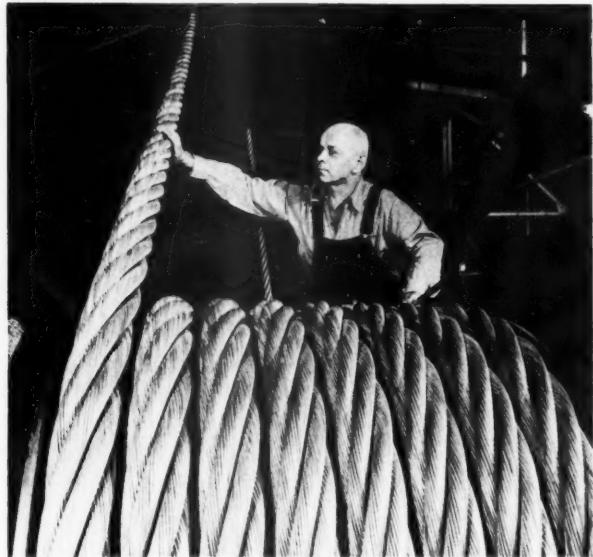
Why Tiger Brand leads . . .



RESEARCH AND ENGINEERING American Steel and Wire has built up one of the finest staffs of wire rope engineers in the country, and in addition can draw from any of the basic research being performed by the United States Steel Corporation. In practice, this means that Tiger Brand Wire Rope is made from the best materials and finest steel being produced. The rope construction is engineered to fit the job . . . and you get a rope that will give the most service at the least cost.



QUALITY CONTROL This means that specified standards of quality are maintained for every step of production from ore to finished product. You can be sure of getting the same high-quality wire rope time after time. The illustration shows an electronic inspection machine, exclusive with American Steel & Wire, that detects if a wire rope imperfection exists, records it on a chart and marks the spot on the rope.



PLANT FACILITIES These are unsurpassed in the industry. American Steel & Wire can make any type and size of wire rope and strand up to the large 4-inch pre-stressed suspension ropes shown here. These ropes are being used on the Pennsylvania-New Jersey Turnpike bridge.

USS AMERICAN TIGER BRAND WIRE ROPE

UNITED STATES STEEL





MOVING the richest hill on earth

The open pit mining of copper ore from Montana's famous Butte Hill has added a new chapter to the long saga of underground mining at "the richest hill on earth."

Begun as a pilot operation by the Anaconda Company late in 1954, the open pit work has proved so successful that plans are going ahead for mining a near-surface ore reserve currently estimated at 100-million tons.

When the F & S Contracting Company of Butte were awarded this vital earth-moving job, they chose Mack LRVSW's. The popularity of these six-

wheeled, off-highway dumpers has been firmly established by an unmatched record of dependable and economical service. Day and night, winter and summer, these "big boys" stay on the job—handling the heaviest loads under all conditions. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

4135



Haul **heavy** loads at



high speeds at low cost with



JEFFREY CLASS 66 SHUTTLE CARS



MORE round trips per shift with bigger payloads is typical of Jeffrey Class 66 Shuttle Car performance, operators find. Enthusiasm runs high, too, for this car's maneuverability. It has positive 4-wheel drive with no-slip differential between wheels on the same axle, for easier steering and handling, especially on curves. Loading and unloading are fast because the operator has the aid of the variable speed hydraulically driven discharge conveyor. The conveyor can be instantly reversed to clear jammed lumps. The 66 car is available in basic heights from 30 to 42 inches.



AND JEFFREY 80-A BELT CONVEYORS



Record tonnages at the face need fast main-line haulage or production soon bogs down. Jeffrey's solution is the 80-A Belt Conveyor. The husky head section has tandem drive for maximum contact with drive pulleys and a pneumatic takeup for proper slack tension on the belt. The head is built for drives up to 160 HP and belt speeds up to 600 FPM. Sturdy frames for 30 inch or 36 inch belts complete this conveyor transportation system which can't be surpassed for high tonnages and rough-duty service.

The Jeffrey Manufacturing Company, Columbus 16, Ohio



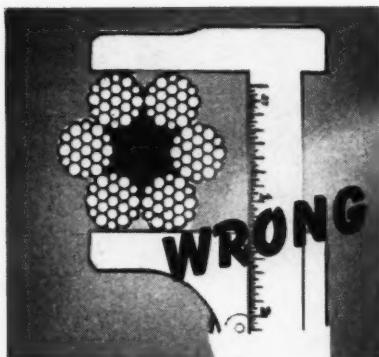
JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

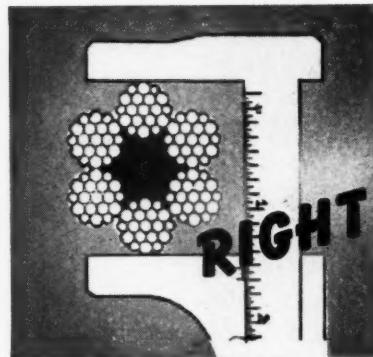
Tuffy® Tips



If Present Rope Is Correct Size, Measure with a Caliper



Measuring the Wrong Diameter
is a common mistake that some buyers make when they order replacement rope. When the rope arrives, it turns out to be too small—even though a machinist's caliper was used to assure accuracy. It's an easy mistake to make, but it's just as easy to remember the *right* way and be sure you get the right size rope. Otherwise both the safety factor and service life of the rope will be reduced.

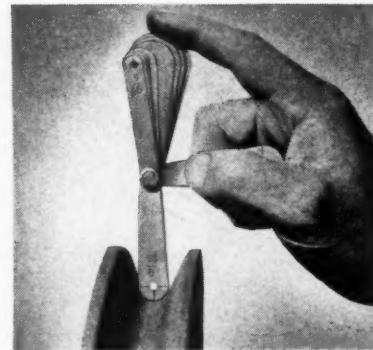


Measuring the Right Diameter
is the simple step shown above. Measure so that a single strand is on each of the adjustable edges of the caliper—not two strands that measure as a flat side. The actual diameter of a wire rope is the same as that of the circle required to circumscribe it. The diameter of a wire rope is an important factor in determining the safe working load to be handled by your equipment.

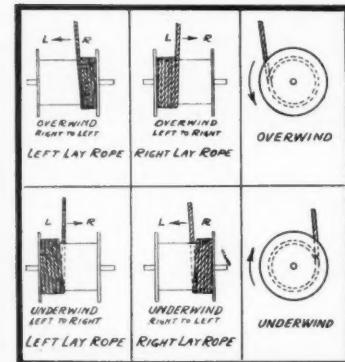
How To Measure Groove Diameter



Shown above is the *WRONG* way to measure the groove diameter. The result—shorter life of the wire rope you buy. Note that only the sides of the rope will bear on the sheave. In a relatively short time this will squeeze the rope out of round and set up destructive friction and stresses on the rope strands and wires. New rope is over-size and diameter of grooves on sheaves and drums should be slightly larger.

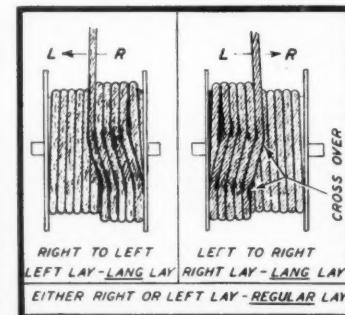


Shown above is the *CORRECT* way to measure the groove diameter. It is a simple thing to do and will give the rope you buy a chance to deliver all the service it possibly can. Remember a wire rope is composed of many closely correlated working parts and sheave grooves which are too large or too small throw them out of alignment. Just like any other working part on a machine, wire rope cannot do its best if it is misfitted.



Rope Lay for One Layer Winding

These diagrams show when it is best to use right lay or left lay rope on one-layer winding. The direction of winding is determined by standing behind the drum, looking toward the direction of the rope travel.



Rope for Two Or More Layer Winding

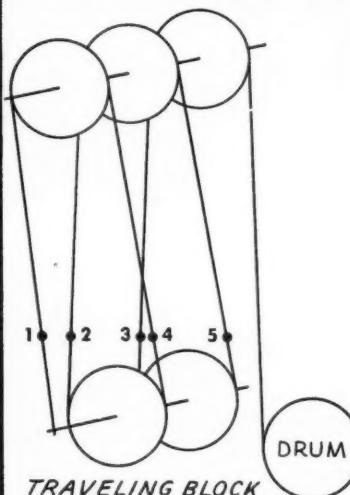
When a rope winds on the first layer across the face of a drum, it usually travels in a uniform pattern. But when it reaches the flange of the drum, the rope rides on the last strand of the first layer for one turn. Then, it slips into the grooves between each course of rope on the first layer. To move across the drum in this manner, the rope actually winds *back* a turn in each revolution. Then it must jump across two grooves in the first layer. This always occurs on the even-numbered layers, and often causes crushing. This abuse is minimized by use of properly designed grooves, spacers and lifters.



In Shoes Or In WIRE ROPE Misfitting Is Hard On The Pocketbook



How To Count The Number of Parts Supporting the Load



Draw an imaginary line across the parts of the rope supporting the load.

The wire rope on many machines is not used in a single or direct pull. It is often reeved through sheaves, which gives a mechanical power advantage.

Send For Free Chart Which Allows Easy Figuring of Actual Stress On Rope For Any Given Piece of Machinery Reaving From One to Eight Parts.

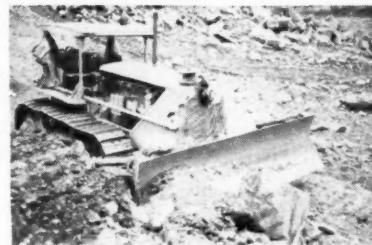
Replace Worn Sheaves

Check for sheaves that have been badly worn. Sheaves that have grooves corrugated by the rope lay impression should be replaced immediately before installing new rope. Since rope creeps to a certain extent on sheaves these grooves can actually cut the strands as the rope runs over. This will greatly reduce service life of *any* wire rope.

Breaking In New Rope

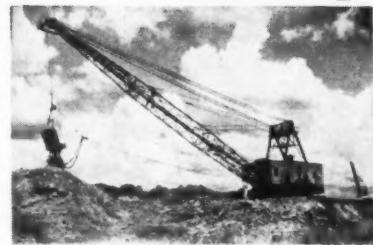
After a wire rope is installed, it is advisable always to run the new wire rope with a light load or with no load for a short period of time. This "breaking in" process gives the component parts of the rope an opportunity to adjust themselves to the conditions under which the rope is to operate. The time spent "breaking in" a wire rope will pay dividends in extra useful rope life.

Don't Say "Wire Rope"—say **Tuffy**



Tuffy Dozer Rope

Mount a 150' reel of 1/2" or 9/16" on your dozer, cut off only worn sections, save good rope otherwise wasted.



Tuffy Draglines

Extra toughness for prolonged service. Flexible enough to hug the drum when casting. Extra resistance to abrasion. Cuts replacement costs.



Tuffy Slings

Proof tested for strength. Easy to hitch on and off. Kinking will not materially damage the 9-part, machine braided construction. Team up with Tuffy Hoist Line.



Tuffy Slusher Rope

Maximum rigidity to fight off drum crushing, yet flexible on small tail sheaves. A unique, high strength 3-strand construction with high abrasion resistance.



Tuffy Scraper Rope

A special rope construction balanced to meet the tough, complex stresses which scraper service deals out.

Your Tuffy Distributor Works to Learn Your Business

When new equipment comes out, he has already checked into it... finding out why it does the job better, how it works. Why? Because he's interested in earning your continued patronage. And part of that service is helping you out with fast answers when you need them—especially right answers to your wire rope problems. Give him a call.

union  **WireRope Corp.**

2144 Manchester Avenue Kansas City 26, Missouri
Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand

ELIPTEX SCREENS ARE

They Provide Sharp, Accurate Sizing and

Eliptex Screens are adaptable — to different methods of installation, to a wide range of applications, and to a great variety of materials.

Whether the material you screen is wet or dry, hot or cold, the versatile Hewitt-Robins Eliptex will give you sharp, accurate sizing. With the Eliptex, you can combine washing, sizing and dewatering into *one operation*, not only saving space and time, but increasing efficiency.

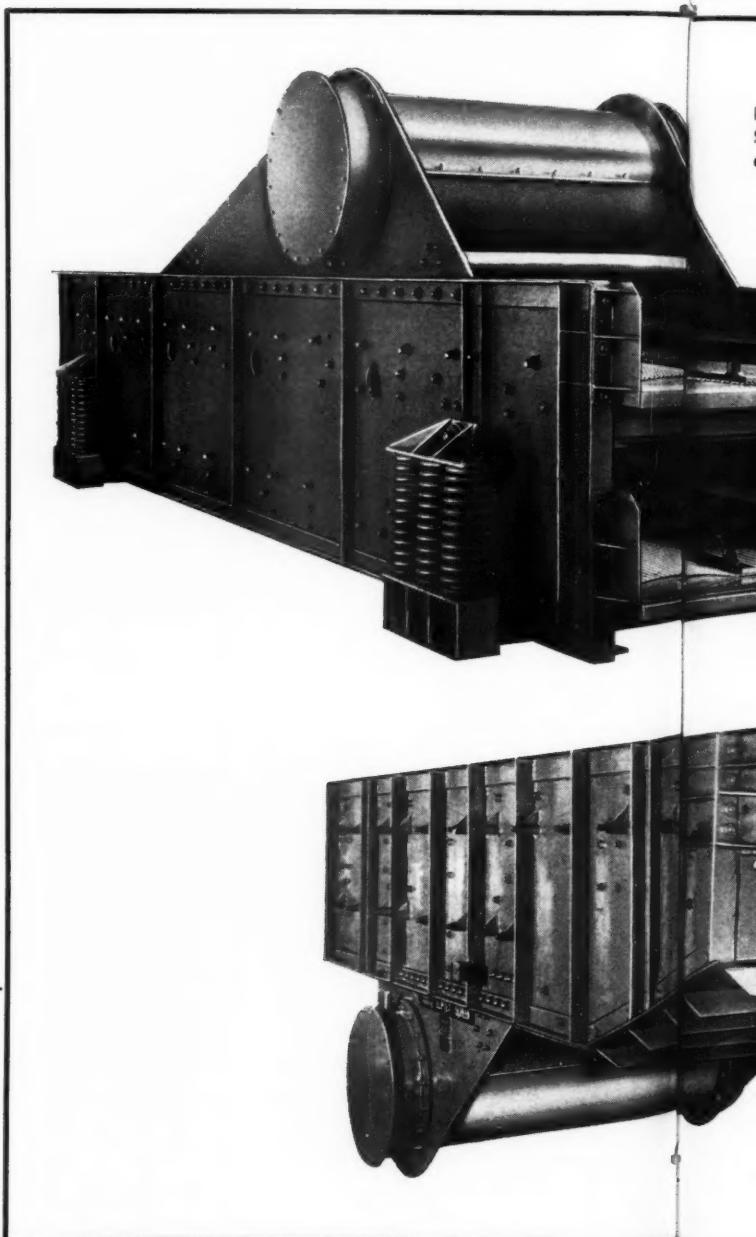
A wide range of sizes is available in single, double, or triple decks with a choice of cloth, parallel rod type decking or perforated plate. You can have the Eliptex with the combination of size, deck arrangement and screen surface most suitable for your plant — whether the material handled is coal, coke, ore, chemicals, minerals, aggregates, or any other.

The versatility of Eliptex design permits easy changing of the range of sizes screened, or easy switching from one plant service to another. Any required maintenance can be handled on the job by your own men using the complete instruction book provided with the screen.

With its exclusive three-way motion, the Eliptex gives you the benefit of easier, less expensive maintenance and repair . . . longer life . . . higher safety factors . . . elimination of nonfunctional weight . . . a greater choice of sizes . . . and *sharper sizing with greater accuracy*.

INDUSTRIAL DIVISIONS PRODUCTS

INDUSTRIAL HOSE • VIBRATING CONVEYORS
CONVEYOR BELTING • CONVEYOR MACHINERY
VIBRATING SCREENS • DESIGN, MANUFACTURE,
ENGINEERING AND ERECTION OF
COMPLETE BULK MATERIALS HANDLING SYSTEMS
"JONES" POWER TRANSMISSION EQUIPMENT
"GLIDE RIDE" THE NEW MOVING SIDEWALK



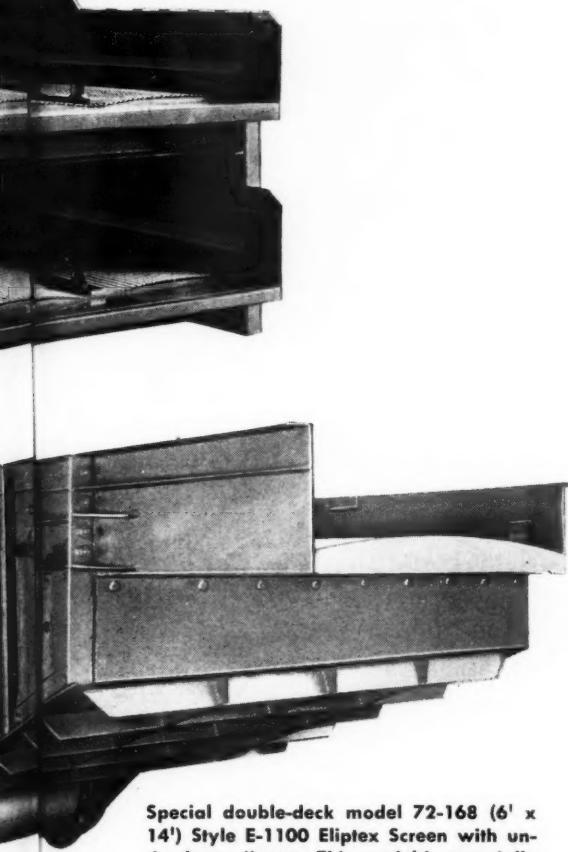
HEWITT

STAMFORD,

ADAPTABLE

Effective Dewaterizing

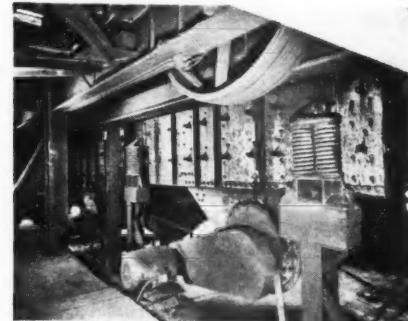
New, simpler, more rugged design of the Eliptex Screen is shown in this photograph of the standard double-deck model 60-240 (5' x 20') Style E-13.



Special double-deck model 72-168 (6' x 14') Style E-1100 Eliptex Screen with underslung vibrator. This model is especially suited to installations where headroom is a problem.

-ROBINS

CONNECTICUT



INDUSTRY CASE HISTORY

Headroom Problem Solved by Eliptex Screens

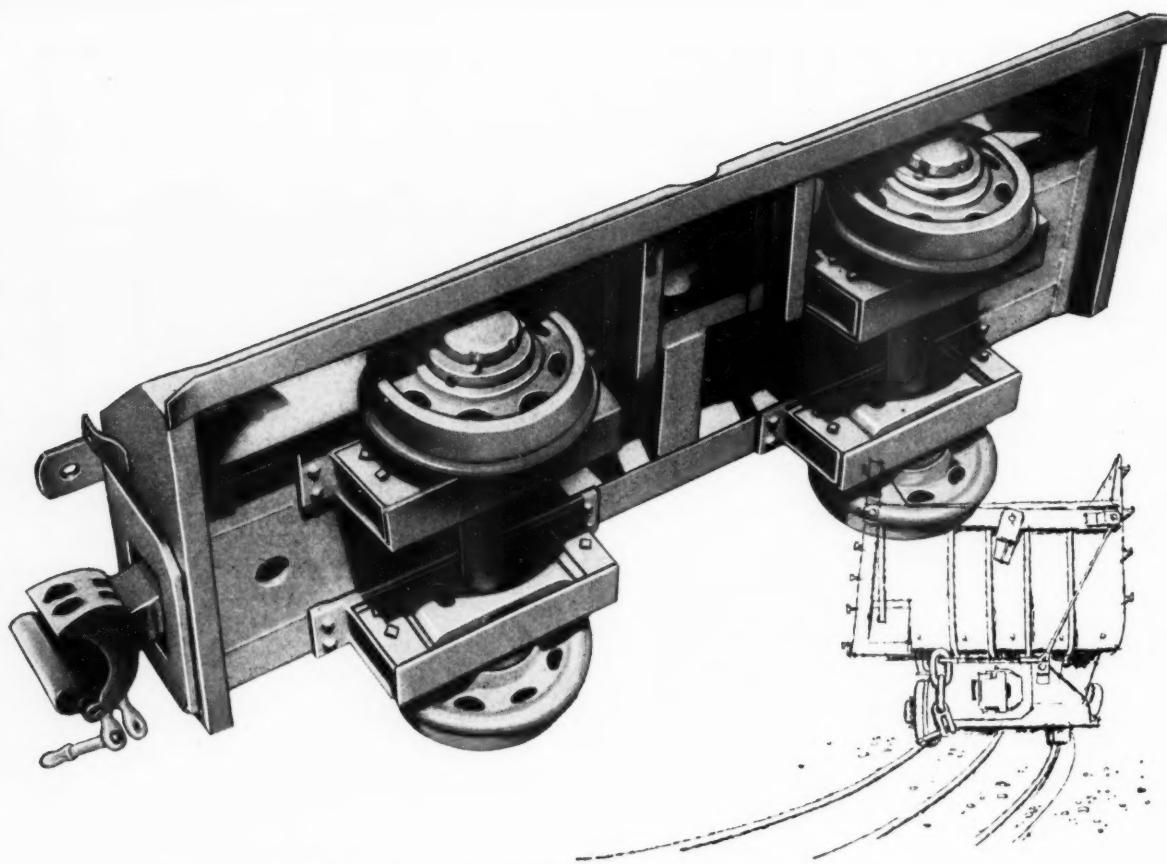
Headroom limitations set up a difficult problem in the installation of Eliptex Screens at the United Pocahontas Coal Company mine in Crumpler, West Virginia. In a normal arrangement, the two screens would not fit into the existing tipple under the shaker screen and feed to the existing equipment.

To overcome this difficulty, Hewitt-Robins revised their standard Eliptex Screens so that the vibrator could be underslung. Thus, Hewitt-Robins engineering was again able to demonstrate the versatility and adaptability of the Eliptex Screen.

The two screens are mounted directly beneath a shaker screen with 1½" openings and operate in tandem to perform a fine screening job before a coal washer. The top deck takes "overs" directly to the washer; the bottom deck acts as a feeder with a long discharge lip, dumping the fines onto a conveyor. At this point, the fines are mixed with washed fine coal and loaded into railroad cars.

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for extra strength
it's CRUCIBLE **MAX-EL** alloy steel

Mine car axles always take a beating. But where service is especially rugged, manufacturers — like C. S. Card Iron Works, Denver, Colorado — use Crucible Max-el 3½ alloy steel. In their own words, here's why . . .

"We use Max-el 3½ because of its high-strength . . . good fatigue resistance . . . and over-all economy."

Good reasons why Max-el, or another of Crucible's wide range of special alloy steels, may be the right answer to many of your more exacting applications. Your local Crucible representative will be glad to give you more details.

Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America

How Bucyrus-Erie Bonus Quality Helps You Cut Costs, Increase Output



This is the Bucyrus-Erie 38-B shovel that won praise from its owner in this stripping operation near Oliver Springs, Tenn.

To discover the real advantages of Bucyrus-Erie Bonus Quality put a Bucyrus-Erie shovel to work in your pit. That's what Chas. Walls and Sons, Oliver Springs, Tennessee did.

Walls' job was to strip four feet of sandstone and 25 feet of shale and dirt to get at the coal in a mine near Oliver Springs, Tenn. The complete job involves excavation of 1,200,000 yards of overburden. After putting a Bucyrus-Erie 1½-yd. 38-B to work for a year, Walls commented, "Excellent service, strongest built of any shovel of its rated capacity."

"Strongest built" is just a part of the advantages of Bonus Quality. Not only do you get design and construction that adds years of life and keeps maintenance costs low, but there's extra performance value, too. There is high-speed operation that delivers big output. There is dependability that keeps big output coming day after day.

When you plan to add a shovel to your operations, be sure to get the story of Bonus Quality from your Bucyrus-Erie Distributor. Remember to see him soon.

243E56

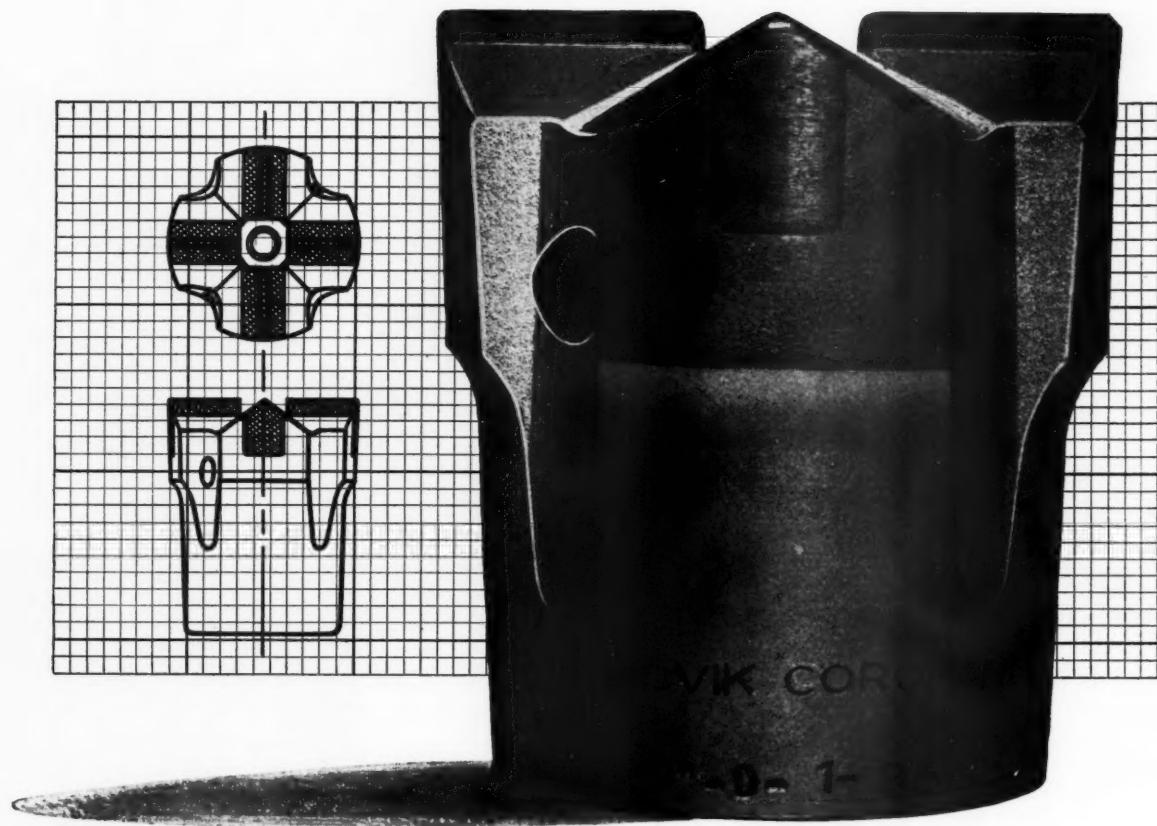


Bonus Quality Bucyrus-Erie uses highest quality steel, then flame hardens it to bring you gears and pinions that wear long, keep costs low.

**BUCYRUS
ERIE**

South Milwaukee,
Wisconsin

THIS ROCK BIT IS PRECISION-MADE FOR A HIGHER PERFORMANCE

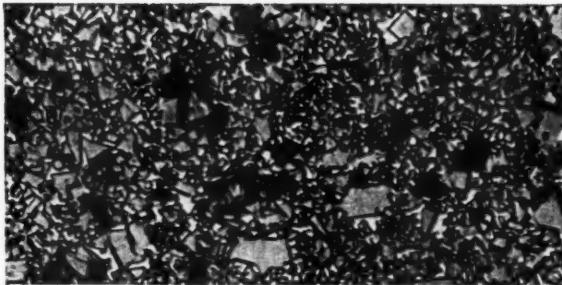


**Nothing tougher and more wear-resistant
than the insert of a Sandvik Coromant 776 bit**

Rock bits that go on and on must have highest-grade tungsten-carbide inserts. Nothing but tungsten carbide in its purest state is good enough, will last as long. That's why the carbide that goes into a Sandvik Coromant 776 bit is meticulously controlled.

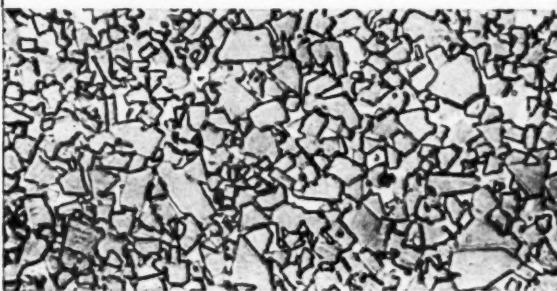
Sandvik, the world's largest manufacturers of brazed-in tungsten-carbide inserts for rock drilling, control every phase of production. Coromant carbide is scrutinised for impurities from the very first stages

of processing the tungsten ore, right through to the final inserts. Add to that Sandvik's special process of securing the insert to the body, employing an exceptionally strong bonding metal, and you know why a Coromant 776 bit lasts longer. In 1955, one billion feet were drilled with these inserts, all fitted to Sandvik Coromant bits or integral steels. *Nothing is more conclusive of the quality of Coromant bits than this figure.*



LOW QUALITY TUNGSTEN CARBIDE

These are unretouched, 1200-times-enlarged micro-photos. Above, carbide full of impurities. Those black marks are contaminations which are present when production and quality control are deficient. Contamination of this kind weakens the carbide and reduces its working life.



SANDVIK COROMANT TUNGSTEN CARBIDE

This is Coromant carbide. Notice the uniformity of size and the even distribution of grain. Coromant inserts are free of dangerous porosity and impurities—the reason they go further, have greater strength.

SANDVIK COROMANT 776 BITS

and Sandvik Coromant integral steels are available in standard sizes through Atlas Copco, who, in their own field, are the world's largest manufacturers of rock drills. Contact any of these offices *today* for further information and a demonstration.

Nothing stands the strain like the Swedish body of a Sandvik Coromant bit

When you put the strongest possible tungsten carbide into a rock bit, the body has to be the strongest available to take the extra strain. That's why Coromant bodies are made of high-quality Swedish alloy steel. But that's not all. Inserts and clearance are cylindrically-ground and the insert ends precision-tooled to exactly the same height. This means *smoother* drilling and *smoother* holes, because the load is equally distributed on all four inserts. *Precision engineering such as this give Coromant bits a longer life!*

Nothing fits like the precision-milled threads of a Sandvik Coromant bit

In order to get a smooth profile of the highest accuracy, Coromant threads are precision-milled in a special thread-milling machine and not made with a tap. Precision-milling too protects the skirt from common fatigue failures.



U.S., Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California. Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA, Atlas Copco Canada Ltd., Montreal, Airport, P.Q.

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Atlas Copco

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment



Face drilling at Enoco Collieries with Kennametal DBL Rotary Drill Bits

Kennametal DBL-2 3/4 Bit

This DBL Bit drilled 3500' with 11 regrinds

KENNAMETAL* DBL-2 3/4 BITS ARE USED AT ENOCO COLLIERIES

because they provide: low bit costs: 8 1/2 mills per ton . . . low power requirements . . . reduced maintenance on drill motors . . . lengthened service life of bits, augers and thread bars

Enoco Collieries, Bruceville, Ind., selected Kennametal DBL 2 3/4 Rotary Drill Bits for drilling face in tough Indiana #5 Seam . . . but only after completing a series of carefully controlled tests. Results: 55% lower bit cost.

Kennametal DBL Bits averaged 354 holes from 7' to 9' deep. Total bit cost per hole, including cost of an average of 10 resharpenings, was \$.0216, or 8 1/2 mills per ton. The second best carbide bit averaged 172 holes at a cost of \$.0487 per hole, or 19 mills per ton.

In addition, Kennametal DBL Bits contributed to other important savings. Freer cutting draws less power, reducing (1) wear on thread bar boxing

and (2) electrical maintenance on drill motors. The life of thread bars and augers was greatly increased. As a matter of fact, these savings are so important, according to Enoco's superintendent, that DBL Bits would have been Enoco's choice even if bit cost per hole had showed no advantage over other bits.

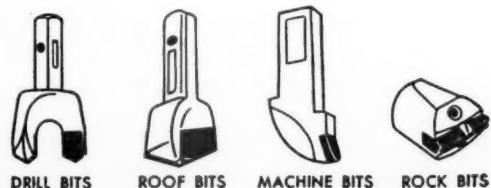
No matter what your cutting or drilling problems are, you will find a Kennametal Bit that will do the job fast, and provide low bit and maintenance cost and long bit service. Discuss your problems with a Kennametal representative. Why not write today to KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania.

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Mining

CONGRESS JOURNAL

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Number 11

Keeping Pace

ON the pages of this issue you will see a report of the American Mining Congress Convention and Exposition in Los Angeles, October 1 to 4. The mining industry was thoroughly examined at this meeting and was found to be a vigorous, forward-looking segment of the national economy.

The minerals extraction business of the country has accepted a long range viewpoint and is looking ahead to continuing growth and advancement. Though properties will be abandoned as their mineral values are depleted, and outdated mining methods will be superseded by better ones, the mining industry is keeping pace in our competitive economy—as it must continue to do if we are to preserve and improve our way of life.

The AMC Exposition offered proof that mining is a dynamic industry. Equipment manufacturers displayed products that have been developed to give the industry the maximum in operating efficiency. Mining is by nature a complex business, and our manufacturers have to come up with continually improved machinery. Each year's developments show that they are trying hard to give us the best equipment possible for the jobs we are doing. And as the jobs will change with the passing of time, so will the tools we use.

The convention program went into the operating and policy considerations of the industry with particular zeal. Meetings were attended by men from all levels of professional attainment who had in common an alert interest in mineral extraction and treatment.

Industrial minerals producers demonstrated, during the two sessions devoted to their field, that they are contributing greatly to mining progress by practicing the most modern methods of production, processing, and administration. This opened the eyes of many a hard rock metal miner from the more traditional mining fields.

The youthful uranium industry has "come of age" as evidenced by numerous excellent presentations on mining and milling techniques that are being developed and practiced on the Colorado plateau and in other uranium areas.

The conventional problems of underground and

open pit mining, underground drilling, milling and metallurgy, exploration and geology, and health and safety were given extensive study and thought. Speakers came forth with information on all phases of these problems, and consistently large and attentive audiences proved that the industry is determined to find better solutions—and to keep on growing.

Leaders from government and top management pinpointed the broader problems of the industry by airing the legislative developments and discussing policy questions. The "general sessions" of the convention did a great deal to consolidate the viewpoints of mining men everywhere—which are set forth in the Declaration of Policy adopted by the Convention which appears on pages 97-104.

So we sum all this up in the observation that the industry as a whole has been making real progress, but we qualify this by saying that there are, and always will be, problems. The moment we relent in our quest for solutions we're in shaky health.

What is Operations Research?

PROBLEMS in many of the mining companies in the country are being attacked and solved through concerted study and organized methods of analysis by setting them apart as "Operations Research" projects.

Doubtless some readers of MINING CONGRESS JOURNAL have had little occasion to become familiar with operations research, but sooner or later they may find themselves involved in such projects in their own operations.

We are not authorities on the subject, but we do know that these projects require the closest sort of organized teamwork. The successful application of most "O. R." projects requires both detailed knowledge of the specialized techniques that are applicable and a sizable amount of operating data that can come only from the superintendents, foremen and workers on the job. These projects also require executive guidance and sound judgment as well as technical competence and accurate basic data.

Those who usually mastermind the procedural aspects of these projects do not agree on any single definition of operations research. It is not an exact thing like a chemical or mathematical formula, nor is it empirical as in the case of "accepted engineering practice." One of the many authorities on the subject has said that operations research is "the investigation of problems which affect management, using whatever scientific methods are appropriate, and resulting in recommendations which lead to executive action"; another, that it is "a scientific method of providing executives with analytical and objective basis for decisions."

No matter how you describe it, this method of attacking knotty problems as they arise is meeting with increasing popularity and success.

Auto Trucks Underground



Tri-State Zinc, Inc. mines at Galena, Ill., have used the smaller Koehring dumptrucks for over six years, and find them ideal for short-haul work in high ground, used with diesel loading shovels

The economical aspects of truck haulage underground are considered by a qualified operator

By GILL MONTGOMERY

Vice-President & General Manager
Fluorspar Division of Minerva Oil Co.

THE USE of auto trucks continues to expand in nearly all types of mines where relatively flat-lying orebodies indicate the adaptability of rubber-tired haulage. This is true of large tonnage mines as well as smaller ones, although the underground truck has more appeal, in most cases, to the smaller operations.

Where height permits and ventilation is adequate, trucks have shown themselves to be the most economical mode of short-haul transportation, and, in many cases, can compete with rail or belt-conveyor haulage in instances where indicated mine-life is short, the daily ore requirements small, or the haulage gradients and directions complex.

They are ideal from the standpoint of maximum flexibility of utilization over a wide mining area, and are the best conveyances to serve in areas where mobile drill-jumbos and mobile trackless loading machines of all kinds are the rule. I have found no

instance in the Middle West where an operator has discarded trucks and returned to rail haulage. It is likewise becoming evident, because of the great increase in conveyor-belt first costs and maintenance costs, that in belt and truck combinations, using trucks to feed long-haul belts, the trend is toward keeping the belts shorter and letting the trucks haul longer distances than formerly. This has been the experience of The Minerva Oil Co., Fluorspar Div., at Mine No. 1 in Hardin County, Ill.

Low-Cost Truck Attractive

In a period in which the costs of mining machinery have ridden the crest of inflation and costs of labor have done likewise, the value of the mineral product, all too commonly, has remained unchanged, resulting in a severe cost squeeze to the operator selling on the open market. To him the relatively low-cost truck is attrac-

tive. The purchase of a new, standard truck fitted with a diesel engine proved seldom to be the most economical course. He found out, as we have in our fluorspar operations, that if he had a fairly good repair shop containing a fair auto-mechanic, he could buy a recent model Ford or Chevrolet two-ton dump truck, install a 29-hp Model DOOD Hercules diesel engine, costing about \$1650, reinforce the frame and modify and strengthen the bed, and have a haulage unit costing only about \$3500. It could haul loads of from five to six tons, and deliver 200 tons per shift at distances over 1000 ft., 250 days per year for at least two years. During that time he could expect to spend from \$1000 to \$1500 on it in tires and repair parts. At the end of that time the truck is often pretty well depleted, but the diesel engine is still in good shape and can be transferred to another almost-new chassis, after over-haul. We have noted that the engines outlive three standard truck chassis.

Trend Toward Sturdier Unit

In spite of the fact that it has been very handy and economical to be able to get truck parts from the village garage, hence allowing a low parts inventory, for several years there has been a trend toward a sturdier truck than is necessary for highway, or even quarry, use in order to eliminate critical break-down times. Our ex-

perience has been that standard trucks soon give us trouble with failure of springs, axles, main frames, universal joints and transmissions, when loads in excess of five tons are handled. The recent use of the Fuller torque-converter with the Hercules diesel substantially cuts down on power train failures, but this item is hard to get promptly or it would be in more frequent use.

Semi-Trailer Introduced

Several years ago, in the Oklahoma-Kansas-Missouri Tri-State zinc district, Landis Machine Co., largely at the behest of the Eagle-Picher Co. through the then general superintendent of mines, Sim S. Clarke, introduced the semi-trailer haulage units. These combined low-head room operating features with greater hauling capacity, but required more maneuvering room and driver skill. Several bottom-dump bodies were tried, but end dump and side dump bodies, with hydraulic hoists, proved most popular. Clarke reports that one of the most economical power units on those he has tested is the Caterpillar DW-10, rubber-tired tractor. Semi-trailers proved more economical on tires and springs, he says, but there are still applications where dump trucks are used. One operation has solved the spring failure problem by developing rubber spring blocks instead of the conventional leaf spring. This results in rougher riding when empty, but loaded it rides well and lasts the life of the truck.

Trucks of the instantaneous dumping variety—like the Koehring Dumptor, are good for quick disposal of waste rock in abandoned stopes, but are hard on grizzlies and feeders. Their total height may be too much for some mines, and they are not used where low roof, or low tonnage demand is a factor.

The Tri-State Zinc, Inc., mine at Galena, Ill., uses Koehring Dumptors for the short haul inside the mine, and 15-ton capacity Tournarockers for the long haul up the inclined adit to the surface, thence to the mill. The company likes the Dumptors best for hauls of less than one mile because of its maneuverability and the saving in turnaround time.

Narrow Gauge Vehicle

When some mines changed to rubber-tired hauling, they found that many interconnecting drifts and haulageways, formerly used for rail haulage, were too narrow for standard trucks. The St. Joseph Lead Co. in Southeast Missouri developed the narrow gauge, heavy duty dump truck, known there as "Little Pete." This truck is now marketed by Western Machinery and Engine Co. of St. Louis. It has an over-all height of only 5 ft 6 in., a width of 6 ft 6 in.,

and a length of 18 ft, and hauls a heaped load of eight tons. It is equipped with 7.50-15 tires—duals behind, a GM 43300 diesel engine, Allison torque converter, multiple-disc hydraulic clutch, and extra-stout construction. However, its price of nearly \$16,000 makes it attractive only to operators who are forced to consider a vehicle of these extra narrow features. The Landis semi-trailer units, large haulers by comparison, range in price from \$25,750 for the 8½ cu yd side-dump trailer, equipped with 18.00-29 tires and towed by a Caterpillar DW-15 tractor, to \$42,000 for the 17 cu yd side-dump trailer on 24.00-29 tires and towed by the Caterpillar DW-20 tractor. These prices reflect most recent price increases.

Advantages of Larger Types

Minerva Oil Co. has started using four-ton rated trucks of standard construction, installing GMC or Hercules diesel motors in nearly new chassis after reinforcing truck and modifying the beds. Their more massive design does not require a torque-converter under ordinary circumstances. Where work is done in company shops, costs range from \$500 to \$5500 for these units. They are preferred over the smaller trucks on ore hauls in excess of one-half mile. They not only can handle a payload of seven to eight tons without undue damage, but incur much less down time for repairs.

The Ozark-Mahoning Co., Hardin County, Ill., operating fluorspar-zinc mines, reports better performance from a Landis semi-trailer unit due to greater delivered tonnage and less maintenance trouble than the dump trucks having the Ford two-ton

About the Author



Gill Montgomery received a B. S. degree in mining engineering, geology option, from the Missouri School of Mines in 1935, and an E.M. degree in 1953.

After six years in oil country geophysics, Montgomery joined Minerva Oil Co. in 1941 under J. H. Steinmesch at the time the mining division was formed. He served as chief geologist in charge of explorations for fluorspar and zinc in Hardin County, Ill., and took an active part in the development of the company's newly developed mines there.

He became general superintendent in 1946, and general manager of the mining division in 1952 after Minerva acquired properties of two other fluorspar companies. He was named vice-president in charge of the division this year.

chassis with 2½-yd beds. Its tractor-trailer unit uses a Case tractor with a D-311 Caterpillar diesel engine and a Landis drop-bottom bed.

Ed Powell, the company's mining engineer, reports that its newest equipment includes Ford trucks with swivel frames to prevent frame twisting over rough mine floors. After



Western Machinery & Engine Company's "Little Pete" truck is tailor-made for the narrow drifts of former haulage systems in the Southeast Missouri lead district



The Landis Machine Company's side and end-dump tractor-trailer units combine low head-room operating features with large hauling capacity

several years of experimenting, the company is building its own shallow, flared bed, with angle-iron lining and a rock-type dump bed gate. The present units deliver 200 to 280 tons per shift over nearly level courses ranging from 1000 to 2000 ft. Dump trucks carry about 5½ tons and the semi-trailers carry about seven tons.

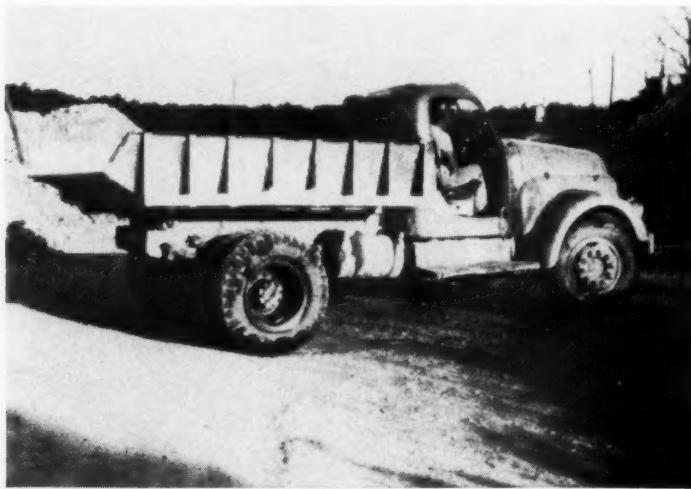
Exhaust Fume Scrubbers

Most operators use crushed stone exhaust fume scrubbers, usually of their own construction. Carbon-monoxide is controlled by careful attention to the diesel motor regulation, with green-indicator tests taken di-

rectly at the exhaust pipe outlets. I have not heard of cases of carbon monoxide sickness due to diesel equipment in mines of any of the larger Midwestern metal-mining companies, even in places where ventilation is considered poor. The good safety record with diesel engines should be noted by the coal industry and consideration given to types of lower cost haulage equipment available to some operators.

Regular Road Maintenance

As with quarry or earth-moving operations, the secret of successful truck haulage, we think, lies in a



These 600 series GMC diesel dump trucks give Minerva Oil Co.'s Fluorspar Division their best haulage costs

regular program of road maintenance. Where over 1000 tons per day are hauled over a mine road, usually daily trimming with a grader or motor patrol will pay in savings on delays, broken springs and axles. A handy supply of gravel for road surfacing is highly recommended, and it is often introduced to working areas through churn drill holes from the surface.

Haulage trucks have maximum utility for other than ore haulage jobs, and usually transport supplies and men, form work platforms for roof-bolting crews, and often tow road grading equipment.

Haulage Costs

Comparative haulage costs per ton are difficult to analyze, largely because of many included utility jobs, differing conditions and methods of cost-keeping between companies. Minerva's highest cost operation with trucks involves a half-mile haul, with a rise of 200 to 300 ft from mine face through sloping adit to the mill ore-bin. The maximum grade is 12 percent against the load. The two-shift operation, with four trucks—three drivers each shift—delivers 720 tons to the mill bin from two mobile slusher loaders. July 1956, was taken as an average, and several high shop charges and tire replacements were included. Average age of the trucks was two years.

Costs per ton, mine face to mill bin, 2600 ft.	
Labor, including supervision and insurance	12.5¢
Depreciation	5.0
Maintenance and repair parts ..	9.5
Fuel and lube	3.3
	30.3¢

At Minerva Mine No. 1, where hauls are shorter and road grades flatter, costs of from 17¢ to 20¢ per ton have been recorded. Good costs are common when equipment is new. Therefore operators are cautioned to obtain operating figures on equipment when it is over a year old to get more representative cost data which can be applied to their own operations. Great cost variations have been noted due to selection of good vs. poor truck drivers, efficiency of utilization of the available truck time, whether the truck was operating through mud and water or on good mine roads, and other factors.

There have been no radical advances in mine truck designs within recent years, but many minor changes to make them more rugged are affecting haulage costs favorably. The trend toward their increasing use is still sharply upward. However, truck equipment manufacturers need to be advised to keep costs as low as possible or their competitive advantage of lower first cost will be lost.



These two underground scenes illustrate mining conditions at the Kenilworth mine. A conventional room and pillar method is employed, taking a maximum of 12 ft of the 16-ft thick seam on the advance and recovering the bottom coal and pillars on the retreat.

The Kenilworth Saga

By GLENN F. JACKSON

Modern Utah Coal Mine Ready for Industrial Growth in the West

COAL was discovered in Carbon County, Utah, in 1849 and has been responsible for the development of many industries in this Western State, serving as a readily accessible fuel for their use. It is the major mineral raw material produced in the county which accounts for about three-fourths of the State's output of coal.

Coal derivatives produced in Carbon County, located on the western slope of the Rocky Mountains, include coke, made in the Beehive coke ovens of the Kaiser Steel Corp. at Sunnyside, and resins obtained from coals treated at the U. S. Fuel Company's preparation plant at Hiawatha. Construction of a new flotation plant for the recovery of this coal resin was started last June. It is reported to be the first flotation plant in the West to be constructed at a coal mine.

Coal is also shipped from Dragerton to the Columbia-Geneva plant at Provo, Utah, where coke is produced for that company's iron smelting and steel-making operations.

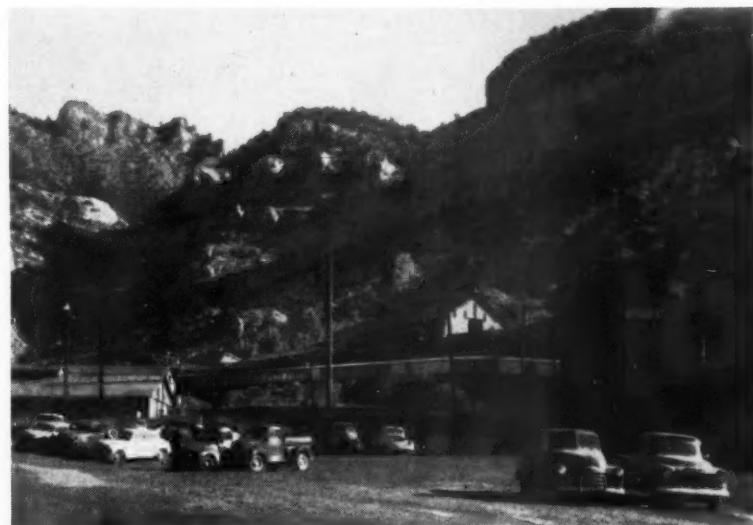
It is the purpose of this article to present an over-all picture of a western coal mine operation, more especially some of the problems involved

when mining a 16-ft seam of coal on a 10 to 11 percent pitch. To accomplish this, a particular operation in

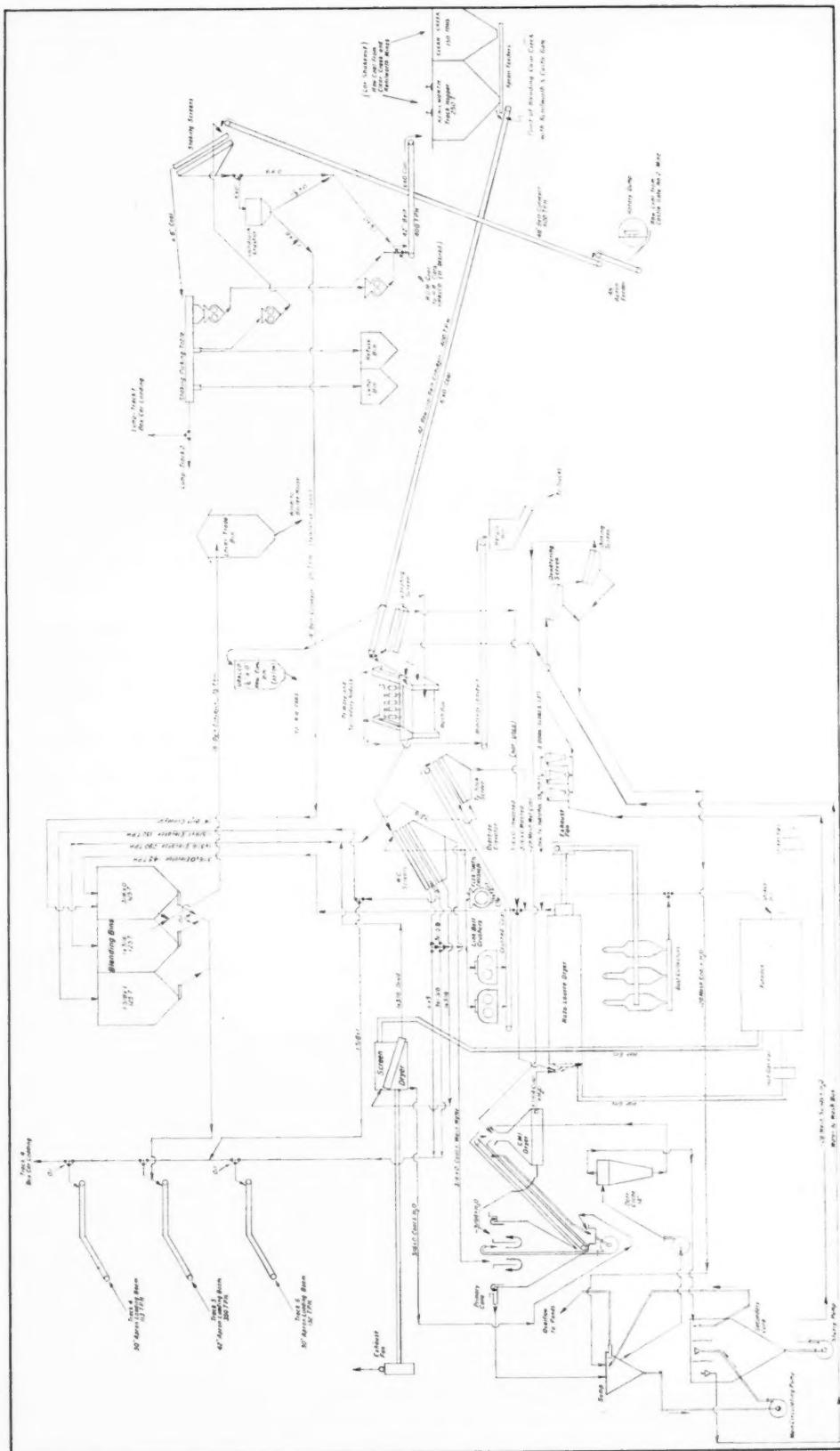
Carbon County, the Kenilworth mine, has been chosen and its mining system described. It is hoped that in this way the reader will gain some knowledge of Utah coal mining practices.

Geology

The Kenilworth mine at Kenilworth, Utah, is in the Book Cliffs coal field



Outside facilities include tipple (right), shop (center), and supply building (left). Note the stockpile of coal at the right.



Flow sheet of the Castle Gate Washery indicates the flexibility of the plant. Coal from three mines is sized, washed and blended here

which extends from Carbon County southeasterly into Colorado for about 175 miles. The field as defined by the United States Geological Survey forms the southern rim of the Uintah Basin and lies north of the Denver & Rio Grande Western R. R. and east of Price River.

The rocks exposed belong to the Cretaceous, Tertiary and Quarternary periods. Three economically important coal groups are in the lower half of the coal-bearing division of the Blackhawk formation, Mesaverde group, Upper Cretaceous period. These basal coal groups are called Spring Canyon, Castle Gate and Kenilworth, and each has a thick cliff-making sandstone at its base. According to the U.S.G.S., the Kenilworth seam at Kenilworth is the equivalent of the Castle Gate D coal bed. Since the latter term is popular locally, it will be referred to as the Castle Gate D henceforth. This is the

478,651. The proposed addition of new equipment and expansion of mining operations will substantially increase production potential.

W. J. O'Connor is president and general manager of the Independent Coal & Coke Co. which owns three coal mines in Carbon County—Clear Creek, Castle Gate and Kenilworth. Other officers of the company include E. O. Jackson, general superintendent; Don Newberry, assistant general superintendent; Tony Fratto, general master mechanic; and Weston L. Potter, chief engineer. Henry Trautvine is general foreman of the Kenilworth mine.

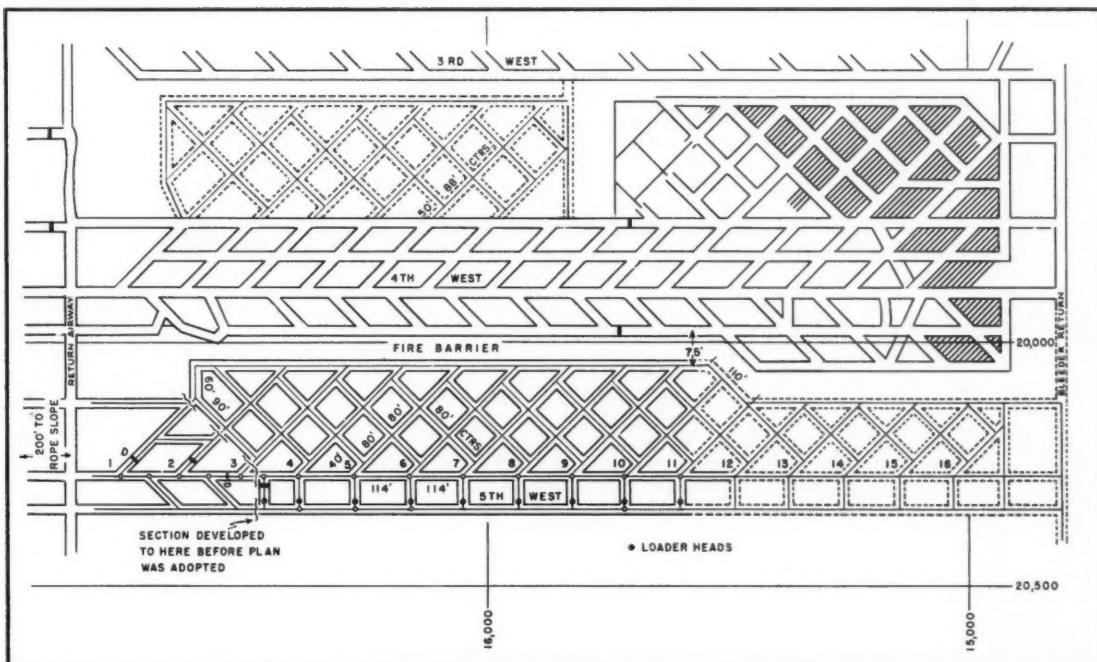
Room-and-Pillar Methods Used

The seam of coal mined by Kenilworth averages 16 ft in the working places and pitches 10 to 11 percent north. It is entered by means of an

It is of interest to note at this point that the bottom coal cannot be entirely removed from a section before beginning pillar recovery. When this was tried, dangerous bounces occurred that made mining difficult and sometimes impossible. To prevent this, only bottom coal in the immediate area of pillars scheduled for early removal is mined—a system which has given good results.

Until recently pillars were made diamond shaped, generally 125 by 106 ft. However, tests conducted by mine personnel have indicated that square pillars on 80-ft centers caused fewer bounces and in general were safer to mine. Thus present and future development work will have square type pillars with the pillar line on a 45° angle.

Another change recently inaugurated concerns fire seals. Previously these were not put in until a section was mined out. Thus a gob fire could



section, then all coal preparation will be done on the night shift. Loading is staggered this way to ease the demand on the two hoists and to lower the electrical power peak.

A typical list of equipment in an off-track section would include:

(1) Two motors—Either eight- or ten-ton gathering motors are used.

(2) Two ten-ton capacity shuttle cars—One section has battery cars while the others employ units with trailing cables. Where battery type shuttle cars are used, the charging station is located in a fireproof structure near the entrance to the section.

(3) One cutting machine—This may be a Joy 10 RU or a converted unit on development work. The converted machine is actually a 7AU cutter mounted on rubber and with hydraulic drill attached—the work being done in the Kenilworth shops. On the pillar sections, which are shot on the solid, a CD-25 or CD-18 rubber-tired drill is used. However, future drills purchased will probably be the CD-40 type. Experience with one of these mounted on a 7AU frame at the mine has been highly satisfactory.

(4) One Joy 11-BU loader.

(5) One stoper plus a 215-cfm compressor for roof bolting—The compressor is track mounted (by Kenilworth) and is generally stored near the loader-head.

The one-track unit consists of a 7AU cutting machine with drill, a Joy 11-BU loader, and a ten-ton gathering locomotive.

All of the face equipment is d-c.

Face preparation varies somewhat but may be described as follows: On development work faces are bottom cut and, if deemed necessary, one or both sides sheared. An average of 16 holes per place are put in by means of a hydraulic drill. (Part of the machine men's responsibilities includes rib bolting which will be described in detail hereinafter.) Generally 50 to 60 sticks of Red H Permissible Unsheathe Powder are necessary to properly shoot the face, resulting in an average fall of 90 tons of coal. Femco 1-10 shot permissible shooting batteries are used by the shotfitters.

In the pillar sections the coal is shot on the solid. Pillars are split and the fenders mined. The bottom coal is drilled, shot and loaded out just ahead of the pillars to be mined as noted before. Pillars, whenever possible, are split downhill for two reasons—roof seems to give less trouble and of course ventilation is less of a problem.

Part of the night shift, when the mine is working five days a week, stays overtime two hours twice a week and rockdusts. Otherwise this operation is performed on idle days. A portable rockduster in each section is used in conjunction with a shuttle car to do the work. Approximately



Newly exposed roof is bolted from on top of a fresh fall of coal

four lb of rockdust is consumed for each ton of coal mined.

The loading crew, working opposite the preparation men, averages about 32 tons per face man or 11.7 tons per man for everybody on the pay-roll.

Two shuttle cars are assigned to each section to minimize production loss due to cable splicing and breakdowns. This is also convenient when it becomes necessary to overhaul one. Cable troubles are rare since only one splice is permitted per cable. Generally cables are changed on the preparation shift. Shuttle cars are equipped so that one car in a section lays its cable to the right and the other to the left. In this manner there is a minimum of cable shifting and the chances of running over cables are reduced.

Only one section uses a loaderhead—a self-propelled track-mounted unit. On the other off-track sections, shuttle cars, by means of a ramp, dump directly into the cars. The Joy 11-BU loads directly into the cars on the track section.

Two motors are used in order to reduce the time lost at loaderhead waiting on empties. One motor with a trip of empties, waits on a side track near loaderhead, ready to move when the loaded trip leaves. Empties are pushed in and the loads pulled out.

Compound M or Aquadyne is used in the water to keep the dust down at the face. The unit is installed in the water line near the entrance to each section.

150 Bolts Per Day Used

Kenilworth installed approximately 150 roof bolts per work day in 1955 for a total of 33,900. The company

is enthusiastic about this method of roof control and claims that rib and roof bolting has made it possible to mine coal that would have been uneconomical and dangerous with conventional timbering. An idea of how the company's confidence in this method has grown may be obtained from the fact that from March 15, 1950 to January 1, 1956, 78,748 bolts were used, with over 42 percent of these installed in 1955. Sizes of the wedge-type bolts utilized (March 15, 1950 to January 1, 1956) are given below.

Size	No.
1 x 2'	200
1 x 4	66,848
1 x 5	6,900
1 x 6	4,400
1 x 8	400
Total	78,748 bolts

Plates used with the bolts were 8 by 8 by $\frac{1}{4}$ in.

Kenilworth is in the process of converting to $\frac{3}{4}$ in. diam expansion bolts.

Timber is only used for warning purposes and for emergencies.

The company's present roof support program calls for bolts on four-ft centers, closer if conditions warrant. The work is generally done on the loading shift by two men using a 90-lb stoper. A 215 cfm compressor, track-mounted by the outside shop crew, supplies the necessary air from a convenient point near the loaderhead. Two-in. pipe carries the air to the working area where one-in. pipe distributes it to the various working faces.

For rib bolting 6 ft by 2-in. diam wood bolts made from cottonwood, together with 12 by 18-in. wood plates

and wedges, have been found satisfactory. The wood plates, incidentally, are ordered with pre-cut two-in. diam holes in the center. This was found to be more economical than doing the cutting in the mine.

Unlike roof bolting, rib bolting is done on the preparation shift by the machine men. Depending on conditions, they may set one or two rows of pins on either or both ribs. Spacing varies, but where used, at least one rib bolt is installed per cut.

In connection with rib bolting the company has found out two things:

(1) Rib bolts are a good safety feature. Large slabs of coal that used to slough off — especially during bounces — and fall over into the roadway, now merely "set down". Very seldom do they pose the dangerous problem that they formerly did. The bolts, though broken or twisted, still continue to hold to a certain extent.

(2) Rib bolts do not interfere with pillar recovery.

Transportation

Transportation is a key factor in this mining operation because of the long haulage involved.

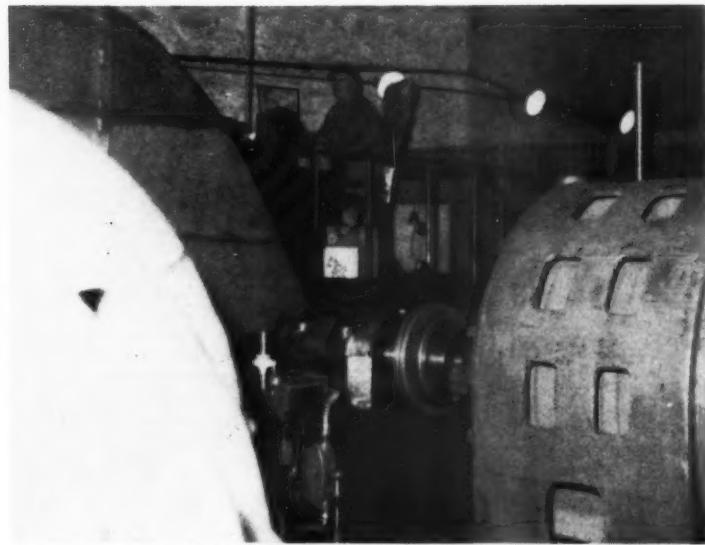
Gathering locomotives pull six- (No. 4 slope) or eight- (No. 2 slope) car trips out to the partings. The mine cars average five tons of coal each.

Two 300-hp motors drive the No. 2 slope hoist. It is equipped with an automatic Lilly hoist controller that prevents overwinding, controls speed and features "dead man" control. With a 1 1/4-in. rope, the hoist pulls the eight-car trips up the slopes at a rate of 1200 fpm. It handles the present output of 270 to 300 cars per shift without any difficulty. A 225-hp motor powers the No. 4 hoist which handles six-car trips.

Four 20-ton locomotives each take 26-car trips out the rock tunnel, which favors the loads, to the tipple. These mainline motors are equipped with magnetic brakes and windshields. The four friction shoes used in bringing each trip out are removed by an automatic shoe puller just before the trip enters the tipple. This shoe puller not only saves time but is an excellent safety device in itself, eliminating the possibility of crushed and mangled fingers that has sometimes been associated with this operation.

Although 55-lb steel is used in the section, only 75-lb and some 65-lb rails are allowed on the mainline.

The company has resorted to various devices to speed-up haulage and minimize lost time. All mainline locomotives are equipped with trolley phones and a dispatcher directs traffic. Signal lights indicate if track is clear. An automatic safety derail with a 70-second time interval provides additional safety on No. 2 slope. Reason for long 70-second delay is to



The No. 2 slope hoist is equipped with an automatic Lilly hoist controller that prevents overwinding, controls speed and features "dead man" control

allow ample time for the slow moving mantrip to pass.

Another safety device that is rather simple in construction but quite effective warns mainline motormen when they have a car off the track. A derailed car often causes a considerable amount of damage, especially if allowed to go any great distance, and it is not always easy for a motorman with a 26-car trip to detect trouble of this sort. Essentially the device consists of pieces of small-wire stretched across the track bed (but underneath the rails) at regular

intervals. These wires are connected in such a way that if one is broken, orange lights located at strategic spots flash on. A motorman, seeing these lights, knows immediately that a derailed car has cut a signal wire and can act accordingly.

To facilitate coupling motors to trips, a handle has been attached to motor links. No doubt this feature has prevented more than one serious accident.

An interesting sidelight to the subject of transportation at Kenilworth is the fact that they still keep one



A completely equipped inside shop installs unit assemblies, handles general overhauls, and takes care of the daily repairs necessary to keep the mine running

horse at the mine for special work. Year by year the haulage distance has increased. Recognizing this fact the company is making a study of a possible underground tunnel between Kenilworth and Castle Gate. All of the coal would then be transported underground to the Castle Gate preparation plant.

Pumping and Drainage

Since the mine at Kenilworth does not "make" much water, it has been necessary for the company to establish a more or less continuous circuit. Water is used chiefly to keep the dust down at the working faces and on the buggy roads.

Small gathering pumps place the water in various sumps where 16-stage deep-well pumps start the water on its way to two 50,000-gal tanks located outside near two of the three mine fans. Although at different locations, the tanks are at the same elevations; thus the water level adjusts itself to the same height in each tank. Since the two reservoirs are at a much higher elevation than the working places, gravity supplies sufficient water pressure. The tanks and pipes together provide enough reserve to eliminate necessity of running the deep well pumps every day.

Electrical Power

Conversion equipment includes six M-G sets (five 250 kw and one 200 kw) and two standard rectifiers. Four of the generators are located in the mine as are both rectifiers. The latter are placed the farthest from the power source. All power stations are in incombustible structures.

Dry-type transformers, because of their lighter weight, have found favor at this mine.

Kenilworth uses 270v d-c and 240v a-c throughout the mine. Face equipment is all d-c. The big pumps, hoists, M-G sets and rectifiers all utilize a-c power.

Safety is emphasized. Underground examples include strategic placing of rockdust, incombustible housings, "home-made" sectional breakers that have done an excellent job of protecting face equipment, oil switches, and good maintenance. Outside protective facilities include lighting arrestors and circuit breakers.

Coal Preparation

Kenilworth Tipple—All coal from the mine is crushed to 6 by 10 in. at the tipple. Of this, generally all plus four in. is run through this plant and the rest is sent to the washery at Castle Gate. This, of course, varies with demands of the current market, but the majority of the coal is treated at the Castle Gate washery.

Hand picking is the only method

of cleaning used at Kenilworth. The coal is crushed and sized according to demand. The company stockpiles some of the lump and stove, sells part as run-of-mine, and sizes the rest according to customers' specifications.

Castle Gate Washery—The Independent Coal & Coke Co. uses its preparation plant at Castle Gate to clean coal from all three of its mines.

At Castle Gate coal from the mine cars is unloaded by means of a rotary dump into a 20-ton bin where a 48-in. apron feeder picks it up and loads it onto a 48-in. belt capable of 600 tph. The belt transports the coal to shaking screens where it is sized. The plus six in. is hand-cleaned and either loaded into railroad cars or stored in a lump bin. The 6-in. by 0 product may be treated three ways: (1) sent to the Gundlach crusher where it is broken into 1% in. by 0 for loading or storing; (2) sold as run-of-mine coal; (3) or mixed with Kenilworth and Clear Creek coal for further treatment in the washer.

The coal brought from Kenilworth and Clear Creek is unloaded into two large hoppers—250-ton capacity for Kenilworth and 150-ton for Clear Creek.

Coal from these bins is loaded onto a 42-in. belt conveyor, capable of 400 tph, which takes it to the washery. The set-up allows coal from the three mines to be blended in any desired ratio.

Since the flowsheet of the Castle

Gate washery that has been included with this article is self-explanatory, a further description of the treatment accorded coal in this plant would be superfluous. However, a few points should be noted:

(1) Flexibility of washery. Not only can the various sizes of coal be blended as desired, but the raw feed from the various mines can be mixed in any ratio demanded. It is possible to by-pass part or all of the washery.

(2) Refuse. It has been found economical to haul waste material away in company trucks.

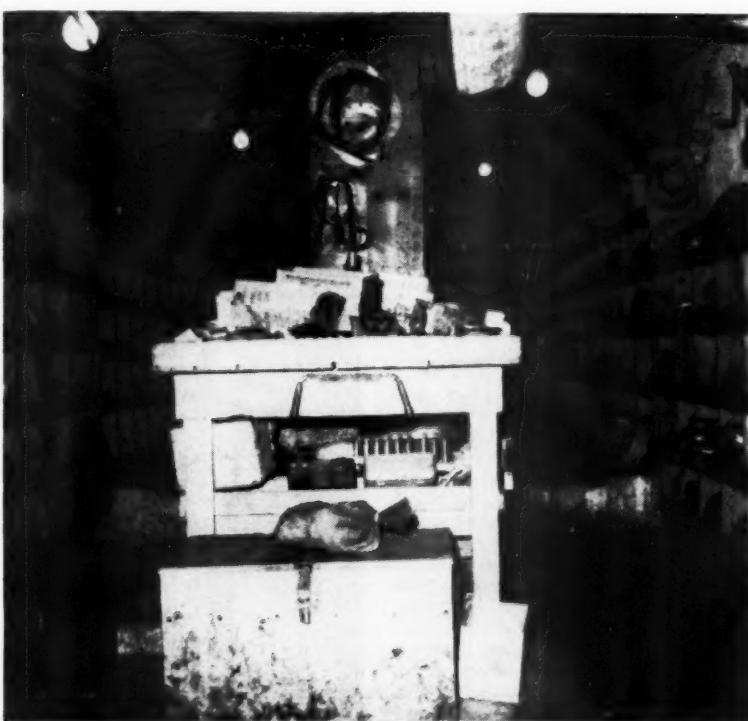
(3) Oil. Approximately one gallon of oil is mixed with each ton of coal.

Maintenance

A well-planned maintenance program is essential at any mine. Kenilworth personnel have given considerable thought and effort in developing their present maintenance system.

The outside shop, located near the tipple, is equipped for any major overhaul jobs, rebuilding unit assemblies for inside shop, remodeling new and old equipment to fit particular jobs, and any other work that the mine or tipple may need. Built by the mine track for convenience, it is well-equipped to handle most jobs that may arise.

Next to the shop is the electrical building. Here four men do armature rewinding, other mine work, and various electrical jobs for the town.



The supply room is adjacent to the underground repair shop

The carpentry shop, a necessary addition, takes care of both the mine and the outside.

A completely equipped inside shop installs unit assemblies, handles general overhauls (where electrical work is not involved), and takes care of the daily repairs necessary to keep the mine operating. Headquartered at the shop are four general mechanics (day shift), plus two others whose job is to take care of the generators and the shuttle car battery charging stations. The night crew is generally smaller.

To simplify its rotation system of maintenance, the company requires a record to be kept of each piece of equipment. When a particular unit is due for an overhaul, a close check is kept on it. At the first sign of trouble, the machine is shopped. The company possesses enough spare units to make this type of program feasible.

Not satisfied with its present successful program, Kenilworth is planning to install a preventive maintenance system in the near future, basing it on the premise that production can and does increase with scheduled maintenance.

Supplies

Two supply buildings have been erected outside the mine. One is used for general supplies and the other, near the mine track, contains emergency equipment.

In addition, a well-equipped supply room has been constructed adjacent to the underground repair shop.

A supply clerk has the responsibility of seeing that the outside warehouse is fully stocked. In the mine a material man orders parts and material as they are used. Supplies requested are generally sent in on the afternoon (second) shift, and are loaded by the tipple crew during slack periods of the day. Since roof bolting has greatly reduced timber needs, material handling is not nearly the problem it formerly was.

395,000 CFM of Air

At the time this article was written, three exhaust type fans supplied a total of 395,000 cfm of air for the mine. Five intakes were utilized. However, plans were being formulated to change to a more efficient system.

Emphasis Placed on Safety

Accent has been placed on safety at this mine. Training programs, safety slogans and signs, numerous safety devices, and a keen interest in the subject by both the men and the supervisory force, have kept accidents to a minimum.

Headquarters for the safety program is a building near the main mine office. Here first aid and mine

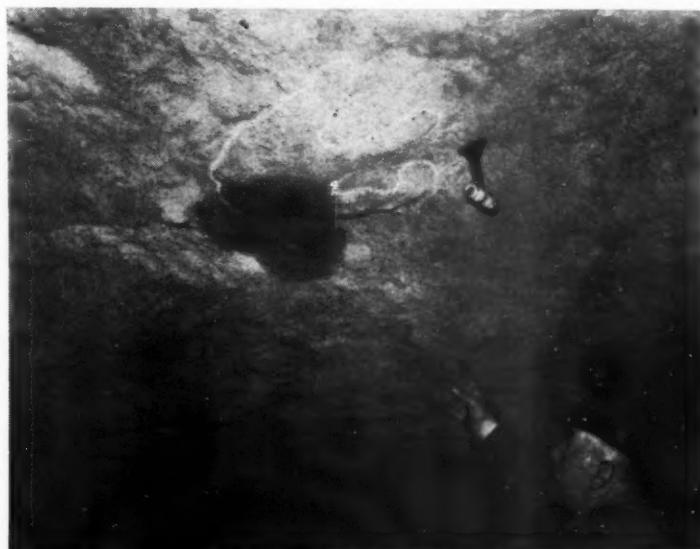
rescue classes are conducted once a year. Attendance at these meetings are good; in fact, in 1955 the company had 100 percent attendance at the Bureau of Mines' First Aid Class. Kenilworth's mine rescue team—four trained crews of six men each—have seen service in various parts of Carbon County.

Various other uses for the safety building include housing mine rescue equipment and serving as a meeting place for any safety sessions or training programs that may be held throughout the year. Pete Corey, safety engineer, also keeps his gas analysis equipment and records here.

hand at all times for emergency use. For mine rescue work, the company has a total of 11 Chemox and 12 Gibbs apparatus.

Another important part of the safety program is the taking and analyzing of air samples on the "cave line" and other critical points. This is done periodically by the safety engineer. He analyzes these samples at his laboratory in the safety building by means of a portable type Burrell Orsat device and other equipment. He checks for CO, CO₂, CH₄, and O₂, and keeps a record of his findings.

The numerous safety devices utilized by Kenilworth—many of which



A hoistman points to what is believed to be a dinosaur track

Several first aid stations are located at strategic spots in the mine. One, a fireproof structure, is located on the mainline, and contains three extra Chemox units, chemical heat blocks, peric acid gauze, blankets, splints, and a stretcher that includes a harness to facilitate using it with mine cars.

In addition, every working section maintains a complete first aid station plus fire-fighting equipment. First aid equipment is also kept at other places such as the inside shop.

Other safety features include 50 to 100 sacks of rockdust around the compressors. One or two fire extinguishers are kept on face units such as shuttle cars, loaders, and machines. All generators, rectifiers, hoists and pump stations are equipped with fire-fighting material.

Two mobile truck-mounted fire trucks are kept at readily accessible points, where they can be sent quickly to any part of the mine. These trucks contain such material as pipe and pipe fittings, fire extinguishers, rockdust and brattice. Six to eight full cars of rockdust are kept on

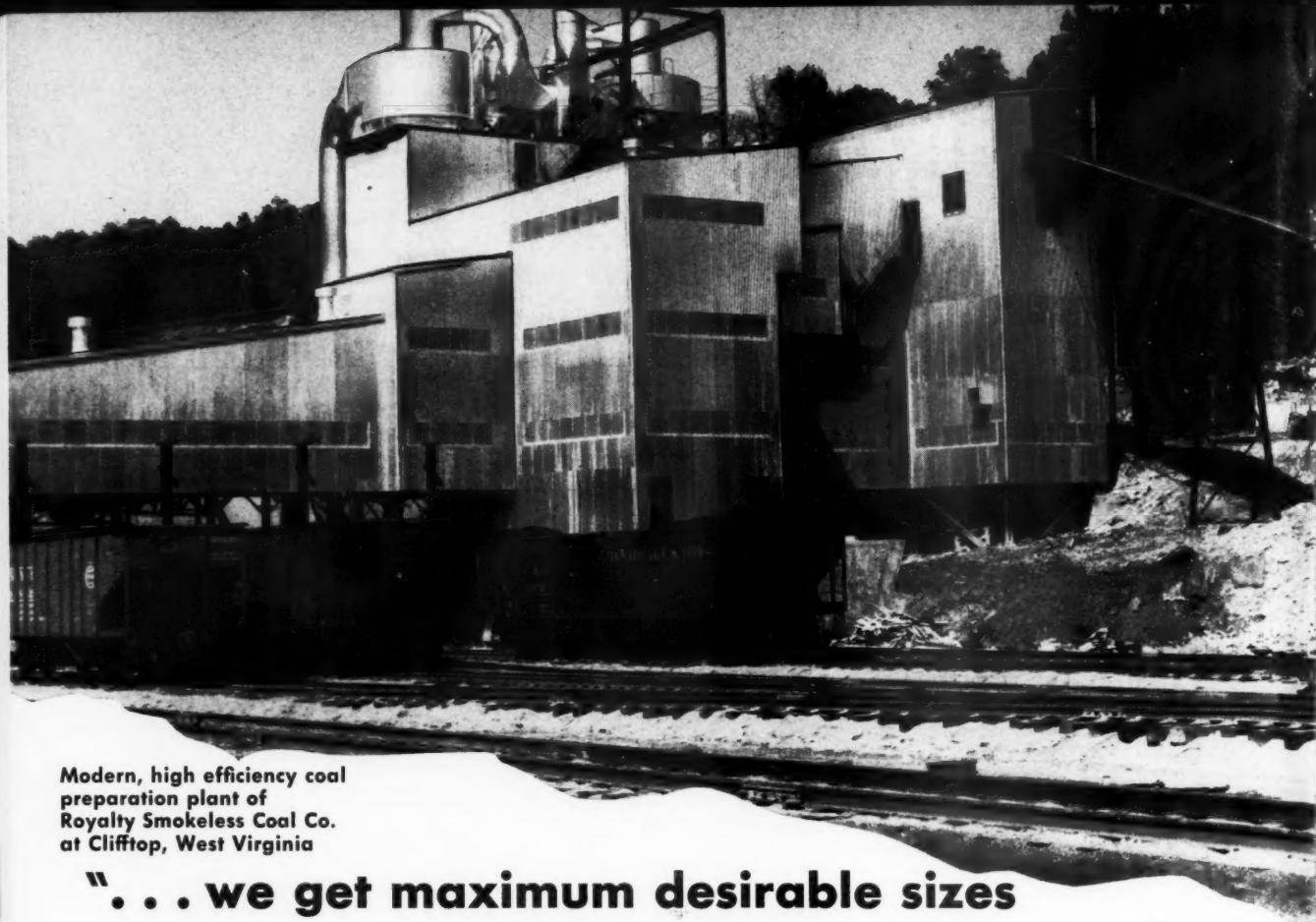
were conceived, built and installed by mine personnel—have already been mentioned.

30,000 Gallon Reservoir

Two new 30,000-gal reinforced concrete tanks are being constructed to hold the town's water supply. This project illustrates the versatility of the company's personnel. Kenilworth, utilizing its own equipment and men, has done a good part of the work. These two tanks will replace the wooden ones now in use.

Conclusion

Kenilworth's well-planned mining operation is constantly being examined for parts that can be improved. Development work is kept far enough ahead to allow for a quick increase in tonnage, when needed, and to allow flexibility in case a section is shut down for any reason. Good maintenance, aided by spare equipment, keeps the operation running smoothly. Safety is constantly stressed.



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New Thor all-purpose one-man drilling machine



THOR introduces the powerful new 390 drilling machine with a host of features which speed up drilling operations and reduce operator fatigue.

This Thor drill is equipped with heavy-duty aluminum cylinder and chrome-plated steel piston rod and a specially designed 45 lb. sinker rock drill with integral feed leg connection. It can be easily converted for sinking. Thor 390 is equipped with a line oiler and automatic water valve which can be replaced with a plug for dry operation or collaring.

All controls are grouped on the backhead for safe convenient operation. A six position throttle, a Thor exclusive, gives a complete range of control from complete shut-off of air and water, to full air and water supply in logical steps for easy convenience and instant control.

Optional feed travel legs available in 36", 48" and the new model 680 72" telescopic leg.

Your nearest Thor representative will be glad to arrange for a demonstration. Thor Power Tool Co., Aurora, Ill.



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MODEL 390
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MOUNTED ON 72"
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The Thor No. 390 is easily adaptable for all types of drilling at all angles. The drill can be removed from the leg for use as a sinker by loosening only one nut. Tool swivels into vertical position for stoping.



After drilling and blasting operations are finished, "C" Rear-Dump moves in to begin clean-up. Daily, the three machines move 1 "round" or 1000 tons of loose limestone. At this rate, tunnel advances about 12 lineal feet per day. In the confined underground tunnel, "exhaust scrubbers" (shown on this machine) made exhaust gas harmless.

Here's where maneuverability really pays off!

Recently the Riverside Cement Co., Los Angeles, California, began tough tunneling operations in their underground limestone quarry at Crestmore, California. Handling all hauling on this project are 3 C Tournapull Rear-Dumps.

Extremely cramped quarters, adverse grades, long hauls on narrow, winding roads, are major problems testing men and machines every day. However, the rugged "C" Rear-Dumps are doing an outstanding job on this rough assignment. Pictures on this page show how "C's" maneuverability pays off when meeting difficulties like these.



Working in extremely cramped quarters like this, big machines turned in dump position which moves rear wheels forward for extremely short wheel base. "C" in "dump position" (shown in this picture) can turn within 20' 8". Its 11' 4" height and 11' width gave ample clearance for the tunneling operation shown here.



Loaded in 6 to 7 passes of 1½-yard Marion shovel, Rear-Dumps averaged 18 tons of limestone per load. 10'4" overall width-of-bowl gives dipper a big "target", makes loading faster, and easier. Minimum spillage was a major advantage in the tunnel work. These "C's" have 18-ton capacity. The new model "C" has 22-ton capacity.



Floor of this tunnel has 10% adverse grades (7% on curves), making for heavy hauling in close quarters. Torque converters on units automatically balance power to load, make operation easier for operator, cut loss of momentum in shifting, prevent killing engine by inexperienced drivers. They also cut shocks in power train and reduce maintenance.



On the entire 6600' cycle, units had only 500' of level haul. The entire route was narrow and winding. Multiple disc air brakes, using 3,763 sq. in. of braking surface, made maneuvering easy... gave operator more confidence on narrow turns. Push button electric controls also contributed to ease of operation and safety.



At a touch of a switch by operator, hoist motor is activated. Body lifts quickly... 18-ton load is dumped easily and fast. Body swings below and behind rear wheels, preventing material from piling under unit. Front wheel drive gives operator control of unit at all times, even when dumping over edge of steep embankment like this.

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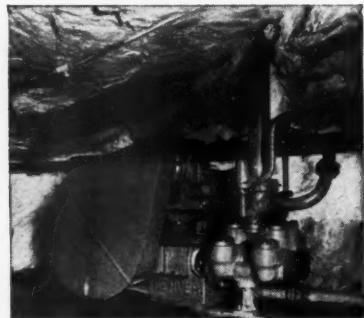
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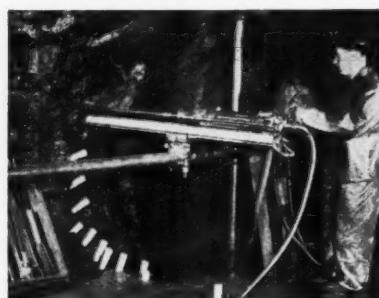
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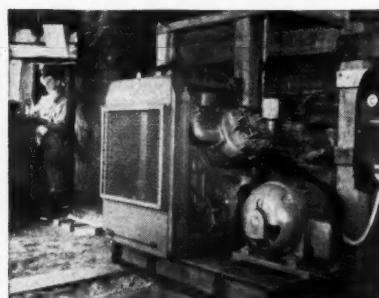
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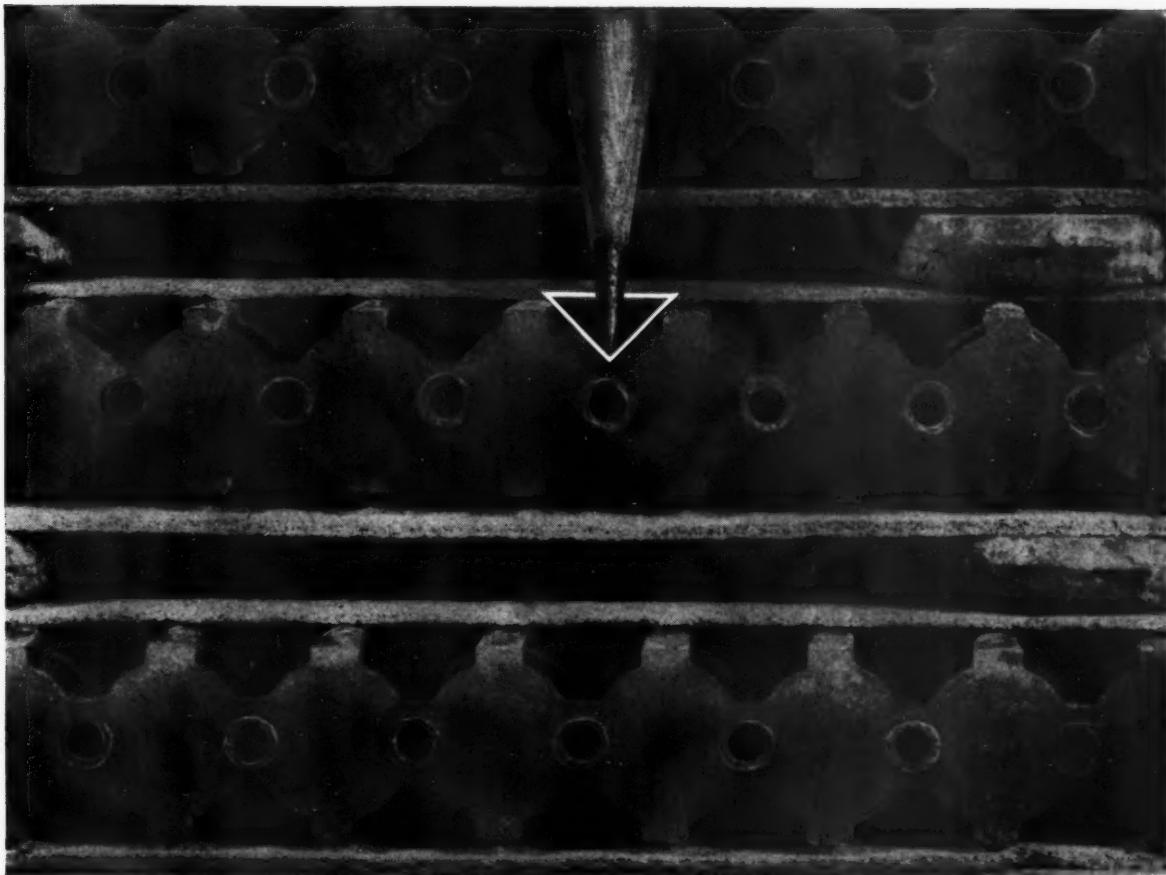
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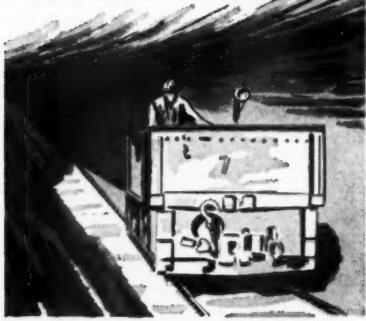
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Jet piercing machine at Babbitt mine spalls a seven-in. primary blast hole at the rate of 18 ft per hour to a maximum depth of 50 ft

Taconite Operation Reserve Mining Co.

The Eastern Mesabi taconites have taken a long time to become economic. This is primarily due to the stubborn characteristics of this hard, dense iron-bearing rock. A leading operator covers the first large-scale project to develop successfully the huge equipment and bulk handling methods for mining and beneficiating taconite

By ROBERT J. LINNEY

Vice-President-Operations
Reserve Mining Company

THE mining operation of Reserve Mining Co., jointly owned by Republic Steel Corp. and Armco Steel Corp., is located at Babbitt, Minn. on the easternmost end of the Mesabi Range. The ore body consisting of magnetic taconite is approximately 9½ miles long, with an average width of 3000 ft. It is wedge shaped in cross section, ranging from 20 ft thick at the north pit limit to 180 ft thick at the south pit limit. The formation strikes S. 60° W. and dips to the southeast

at 5½°. The top of the taconite is very rough and irregular and is covered with a shallow layer from 2 to 20 ft of glacial drift with outcrops to surface in many places.

Exploration Program

This property, leased by Reserve in 1939, was relatively unexplored except for about two miles near the eastern end where diamond drilling was confined to around 50 ft of depth.

In order to gain a better knowledge of the formation in general, a survey was undertaken in 1945 to locate, sample and map all outcrops that could be found on the property. After correlation of these findings, a diamond drilling program was conducted in the fall of 1946 and summer of 1947. This program was designed to obtain a working knowledge and understanding of the iron formation and to substantiate information acquired from previous work. A series of holes were drilled at predetermined intervals along the full length of the property to determine the grade and width of minable formation with regard to pit layout and development.

Several holes were drilled in previously drilled areas to supplement and check the older drilling and to locate igneous intrusions and effect of the Duluth gabbro on the formation. Most of the holes were terminated when reaching the lower slaty member.

Pit Outline Established

With this information at hand along with other pertinent data, a proposed pit outline was established and a calculation of estimated minable reserves and analysis was made possible.

In the establishment of the mining outline or proposed pit limits the south boundary was drawn in order to eliminate any possible rock stripping and the north boundary was held to a minimum bench of 20 ft of upper cherty formation.

Within these pit limits, composed chiefly of upper cherty formation and a small portion of the lower part of the upper slaty formation, an estimated 1.5 billion tons of taconite averaging between 23 and 24 percent magnetic iron is waiting to be mined.

Characteristics of Ore

These large tonnages of Eastern Mesabi taconites, though the first to be discovered on this range by the early prospectors, were the last to be given consideration. This is primarily due to the stubborn characteristics of this hard and dense iron bearing rock.

Taconite has been described as any low grade iron formation, but the big difference between this taconite and many of the others is its extreme hardness reported to be in the neighborhood of 600 Brinell and believed to be the result of contact metamorphism of the iron formation by the Duluth gabbro. It was the stubborn physical characteristics of this taconite that defeated an attempt by Mesabi Iron Co. in the early 1920's to mine and process a commercial product.

Much has been done in the ensuing years by Reserve, in cooperation with other companies, to develop equipment, means and methods for mining and preparing this taconite.

The first and most important obstacle to overcome in the mining was to be able to drill at a reasonable speed and cost to maintain large production. Conventional methods of drilling used in the past were prohibitive. Churn drills, the most popular means of drilling blast holes, produced only 10 to 12 ft per shift and bit changes had to be made every 6 to 12 in. of drilling.

Jet Piercer Used

In 1946 the first experimental vertical blast hole flame piercer developed by Linde Air Products Co. was brought to Babbitt for test drilling. These tests were continued through the summer of 1947 with a vigorous program of process and design changes which led to the development of the present jet piercing machine.

Reserve has been using the jet piercer for all of its blast hole drilling for the past four years with considerable success.

The technique used in piercing is a combination high velocity, high temperature flame produced by combustion of liquid petroleum fuels (kerosene or diesel fuel) and gaseous oxygen in the burner chamber at 150 psi and ejected through divergent nozzles against the rock surface. This action causes a thin layer to spall from the mass and upon rotation of the burner exposes new surface to the flame as the broken spallings are continuously ejected from the hole by steam produced when the cooling

water comes in contact with the heat of combustion. Gaseous O₂ at 150 psi is supplied to the machine by pipeline and hoses from a liquid oxygen converter unit located near the mine site. Fuel oil is brought to the machine by tank truck and water is piped in by gravity from a nearby lake. Process fluid consumptions are 10,500 cu ft of O₂, 40 gallons of fuel oil and 1200 gallons of water per hour. The machine is capable of drilling to a depth of 50 ft. Speeds in excess of 35 ft per hour have been attained but the average rate is about 18 to 20 ft per piercing hour. The jet pierced hole is corrugated due to the difference in spallability of the taconite layers so that a 6½-in. minimum diameter hole has an average diameter of about nine in. Present practice calls for drilling to a depth of three ft below pit grade and chambering or enlarging the bottom three ft by making a second pass over that portion of the hole. This results in increased volume at the bottom for added explosive where it's needed most.

Each Drill Hole Tailored to Fit Conditions

In order to obtain proper fragmentation of material for the crusher, a coordinated program of drilling and blasting is essential. Primary blasting is carried out with high velocity, high density, insensitive, water resistant explosives. Various delay patterns, explosives distribution and hole spacings have been used with the present single row, individual hole delay on an 18 by 22 ft spacing producing reasonably good fragmentation. Because of the extreme irregularity of the taconite surface, backbreak and hardness, each hole is tailored to fit existing conditions and a complete record is made of each blast. The engineers locate each hole, determine depth of hole, height of chamber and calculate the available yardage of each hole. From this information is calculated the powder load, distribution and height of stemming required. In general, we try to load 50 percent of the powder into the lower one third of the hole, then continue up the hole with a lighter column to within eight or nine ft of the top. The remainder of the hole is then filled with stemming. Natural jointing planes that form large blocks above the powder column would ride out on top of the blast without breaking unless something is done to prevent it. To cope with this situation, a series of small satellite holes 1½ in. in diameter and four to six ft deep are drilled between the large holes, loaded with powder, and fired simultaneously with the parent blast hole.

Two detonators in each hole—one near the bottom and one near the top—are each fastened by a double

About the Author



ROBERT J. LINNEY was educated at Worcester Academy and Yale University.

He started as assistant mine engineer Underground Mines at Lyon Mountain, New York. He became level foreman (underground), superintendent of crushing, concentrating and sintering plants and then general manager of all operations.

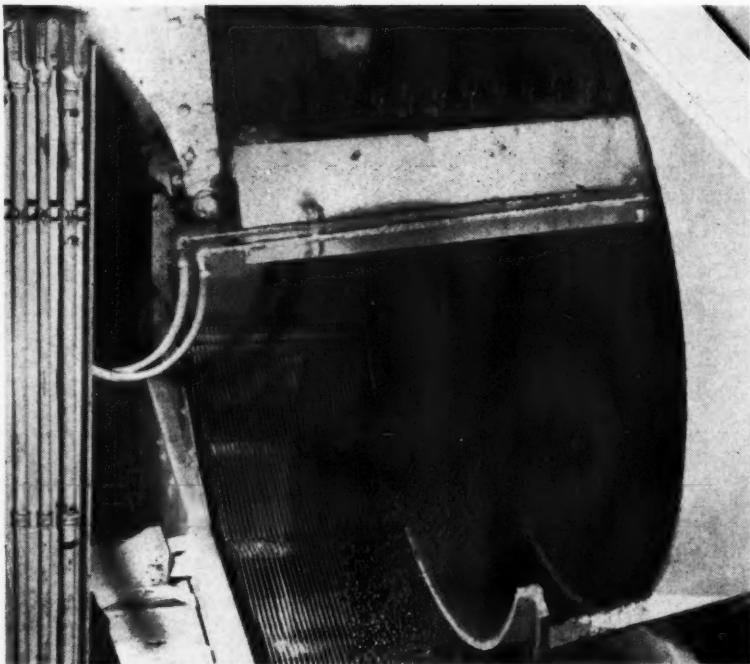
Republic Steel took over the Lyon Mountain and Port Henry operations, and shortly thereafter named Linney general superintendent of the Port Henry district. He became district manager in 1945. Republic's operations in the Adirondacks consisted of mining, beneficiation and sintering magnetic iron ores.

In 1950 Linney transferred to Reserve Mining Co. as manager of operations, and in 1956 was made vice-president in charge of operations.

strand of primacord to the trunk line which contains a 17-millisecond delay connector between each hole. The sequence of firing is varied depending upon condition of face and results required. After the blast, any oversize chunks are cast aside and broken with a 6½-ton drop forging or skull cracker mounted on a 2½ yd crawler crane with a 60-ft boom.

Excessive Tooth Wear

Loading is done with 6½-yd electric shovels equipped with a five-yd manganese steel dipper. The hard abrasive qualities of the taconite causes excessive dipper and tooth wear. Considerable experimenting has been done with teeth made of manganese, alloy steels of many compositions and hardnesses and the application of practically all types of hardfacing electrodes. Where a set of manganese teeth similar to those used in most Range operations would require rebuilding and hardfacing after 250 to 350 truck loads, the presently used special alloy steel one-use tooth produces between 650 and 900 loads per set. No welding or hardfacing is necessary on this tooth—just put it on, wear it down and scrap it. Addi-



Balling drum discharging rolled concentrate balls onto vibrating screen

tional savings are realized by decreased shovel down time for tooth changing and considerable reduction of welding force.

300-HP Trucks Carry 50 Tons

Original plans called for rail haulage in the pit after development of the initial cut with 22-ton end dump trucks. This initial cut is a long narrow one just wide enough to operate one shovel loading into trucks. After a year of operation with experiments in practically every phase of mining, considerable knowledge in preparing and handling this taconite was gained. Since this material has to be blasted hard and moved forward for good breakage, rail haulage would be impractical in a narrow cut of this nature so it was decided to work toward development of a low cost high capacity rubber-tired trucking unit. Several of the major earth moving companies, with our recommendations, designed and built tractor trailer side dump experimental units. A series of tests were conducted and studies made to determine practicability and operating costs as applied to this particular operation. The unit decided upon is a tractor trailer side dump unit powered by a 300-hp engine and capable of carrying an average load of 45 long tons. The trailer and liners are made of high strength alloy steel plate. Experience with present trucks has shown that mild steel truck boxes even though lined with manganese or alloy steel bars won't hold up under impact of shovel loading this hard, sharp-cornered abrasive material.

By using a tractor trailer unit on well maintained roads and minimum pit grades, we are able to increase the payload to over 100,000 lb with the same horsepower now used to haul 45,000 lb with an end dump unit. Road maintenance is of utmost importance to truck haulage; especially, where spillage results in excessive tire cutting. Fine crushings are brought back to the pit and spread along the bottom at shovel loading points. A bulldozer is stationed at the shovel all of the time to push rock spillage from loading and a patrol is used for road maintenance between pit and crusher.

The side dump trucks are dumped at the crusher by a stationary overhead dumping arrangement which hooks on to the side and raises and lowers the box by pushbutton control.

The main crusher is a 60-in. gyratory equipped with two 500-hp motors and crushes pit run material to nine-in. size which drops by gravity to four 30-in. crushers each equipped with a 300-hp motor crushing to 3½ in. The 3½-in. material is then fed by an 84-in. pan feeder onto a 60-in. belt and conveyed to two 5000-ton storage bins. Here it is loaded into 87 gross ton flat bottom railroad cars and transported 48 miles to Silver Bay.

Fine Crushing Plant

At Silver Bay the ore is dumped by a rotary dumper into a large pocket and then fed by pan feeder onto a 60-in. conveyor belt which delivers it to four 4800-ton concrete

surge bins ahead of the fine crushing plant.

The fine crushing plant consists of four units—each unit is made up of two 6 by 12-ft double deck screens and two seven-ft shorthead Symons cone crushers together with necessary chutes and conveyors. The flow of the ore through the units is by gravity and as follows:

From the 4800-ton storage bins, the ore is delivered by pan feeder and belt conveyor to a 6 by 12-ft two-surface vibrating screen with a ½-in. opening on the bottom deck. The material that passes through the bottom deck is dropped directly to a collector conveyor and conveyed to the concentrator storage bin ahead of the rod mills. The overs from the screens is discharged into a seven-ft shorthead cone crusher equipped with a coarse bowl set at an opening of approximately one in. The discharge from this crusher then flows over a second 6 by 12-ft two-surface vibrating screen taking out the minus ½-in. material which again goes directly to the concentrating bins. The overs from the screen drops into a second seven-ft shorthead crusher which is equipped with a fine bowl set at approximately ¼-in. The discharge of this crusher which contains not more than five percent of plus ¾-in. material joins the minus ½-in. material from the screens and is conveyed to concentrate bins. There are 24 of these bins and they have a capacity of 3000 tons each.

Concentrating Facilities

The concentrating plant at Silver Bay consists of 12 individual sections each with a capacity of 1150 tons of concentrates per 24 hour day. These sections are absolutely independent of one another and can be operated separately or collectively. Each section consists of two storage bins, one rod mill, two double drum magnetic cobbers, two ball mills, eight 12-in. cyclone classifiers, eight magnetic belt rougher separators, six double drum finishing magnetic separators, four hydro-separators, one Agridisc filter and other accessory equipment. All of the material flows through the mill by gravity with the exception of the ball mill rougher classifier circuit which requires the use of one eight-in. pump.

From the storage bins the ore is fed by Mexican feeders on to vari-speed conveyors through four openings in the bottom of each bin. These vari-speed conveyors deliver the ore to the rod mill. The rod mills each 10½ by 16 ft are powered by 800-hp synchronous motors and can handle 135-150 tons of ore per hour, producing a product containing not more than ten percent plus ten mesh. The rod mill discharges through an at-

tached trommel screen that splits the feed equally to the two magnetic cobbers. The cobbers are double drum concurrent type covered with an endless belt. Here 35 percent of the initial feed is thrown out as a low grade tailing. The concentrate discharged from the cobbers flows to the ball mills for further grinding. The two ball mills are 10½ by 14 ft and are powered by 800-hp synchronous motors. The discharge of the ball mills is treated by eight belt type magnetic separators and the concentrates pumped into eight cyclones for classification. With the tailings going to waste, the system is set to grind to 80-85 percent minus 325 mesh.

The minus 325 mesh produced in the cyclones is further treated in a 16-ft diam hydroseparator to wash out more of the fine tailings. Underflow is fed to six magnetic finishing separators. These separators are of the double drum counterflow design; the tailings go to waste and the concentrate discharged into two more

feeder screen, one pelletizing machine, one finished pellet screen and one spiral classifier. The returns from this machine are substantially minus 28 mesh and are recovered in a separate operation.

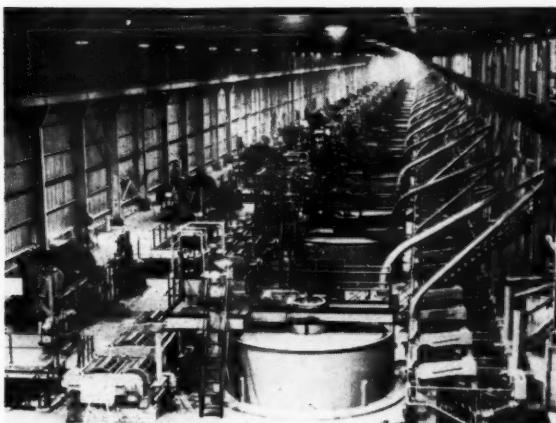
Concentrate filter cake at 9.5 percent moisture is stored in 500-ton surge bins and offer little problem in moisture segregation. This concentrate is fed to the balling drums at a controlled rate preset by the operator. The proper quantity of bentonite is added to the new concentrate through ratio controllers prior to addition of the recirculating load of small balls from the balling drum. The balling drums are nine ft in diameter by 30 ft long and run at about ten rpm. They are driven with a variable speed drive whose adjustment is at the operator's discretion. As the pellets are discharged from the balling drum, they are screened on a 5 by 12-ft screen with a $\frac{3}{8}$ -in. opening. The undersize is returned

of movement, the speed is automatically controlled by the quantity of green pellets fed to the screen feeder.

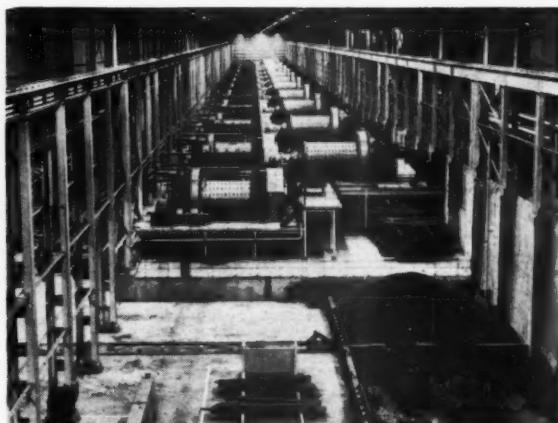
The green pellets are now dried updraft using hot air recovered from the burned pellets. It is then necessary to dry and preheat the top of the pellet bed prior to the ignition furnace which is controlled at 2400°F. After ignition the pellets are burned somewhat in the manner of sinter except that the material is held upon the grates after burn through and cooled to about 600°F prior to discharge from the machines.

As the pellets are discharged, the bed of burned pellets is somewhat clinkered and it is necessary to drop them through a roll crusher set at four in. prior to screening. The screens are of the rod deck type set at 3/16-in. opening, followed by a two-in. opening, and the plus 3/16 in. minus 2 in. is sent directly to the pellet stockpile.

The minus 4-in. plus 2-in. material



Concentrating floor at Silver Bay comprises 12 sections totaling 96 inclined belt magnetic separators, 72 double drum magnetic separators, 48 hydro separators and 12 disc type filters



Grinding section of concentrator at Silver Bay comprises twelve 10 ft 6 in. by 16-ft rod mills and twenty-four 10 ft 6 in. by 14-ft ball mills. Note storage of ball and rod charges in the foreground

16-ft diam hydroseparators for further cleaning. The underflow from the hydroseparators is pumped by diaphragm pumps to a six-disc six-ft diam leaf type filter where the fine concentrate is de-watered to approximately ten percent.

The final product, somewhere between 80-85 percent minus 325 mesh, averages 64.5 percent total iron. From here, it is delivered to surge bins for further processing in the pelletizing plant.

Pelletizing Process

The pelletizing plant at Silver Bay consists of six individual machines, each with a capacity of over 2000 tons of finished pellets per day. Each of these machines can be operated individually or collectively. The machine consists of three storage bins, three balling drums, three green pellet screens, three coal coating drums, one

with the new feed to the drum and the oversize sent to the coating drum.

The plus $\frac{3}{8}$ -in. green pellets are now weighed and ground anthracite coal, centrifuged filter cake, is added just before the pellets are charged into the coating drum. These drums are eight ft in diameter and 12 ft long and rotate at 11 rpm. In these drums the coal is rolled upon the surface of the pellets.

Following the coal coating drum, the green pellets are again screened as they are fed to the pelletizing machine. The undersize from this operation is returned to the concentrate surge bins. This screen feeder is so designed to distribute the pellets across the six ft width of the pelletizing machine as it is very important to have a level bed of pellets on the machine. In order to obtain a level bed on the machine in the direction

is completely immersed in water to insure cooling of these larger chunks for safe conveyor operation. The minus 3/16-in. material is dropped into a spiral classifier which makes a 28-mesh separation. The sand product (plus 28 mesh) goes with the finished pellets and the overflow product (minus 28 mesh) goes to the reclaim section. The finished pellets then consists of three fractions, the minus 4 in. plus 2 in., the minus 2 in. plus 3/16 in., and the minus 3/16 in. plus 28 mesh all of which are gathered on one belt, weighed and sampled.

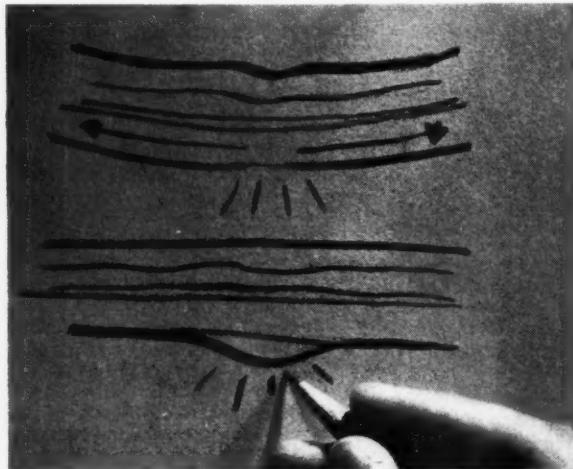
As the pellets are conveyed to the stockpile or to the boat loading section, they will contain 63.5 percent iron, and have about 2.5 percent minus 28-mesh material. After tumbling in a two ft, two lifter barrel for 200 revolutions, the plus $\frac{1}{2}$ -in. portion will generate about 14 percent new minus 28-mesh material.

Rome's shuttle car cable can't be bent the wrong way!



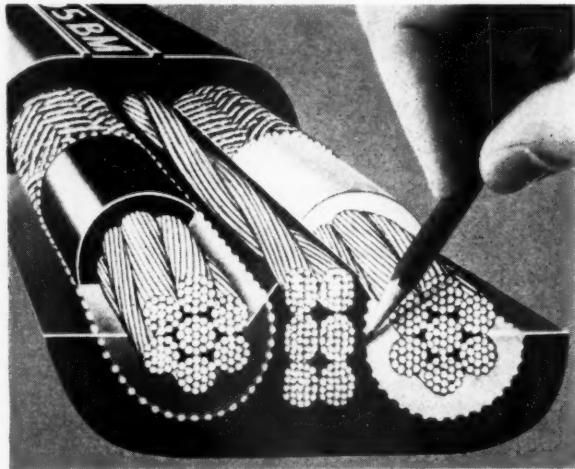
JUST TRY TO BEND IT THE WRONG WAY. Force a length of Rome 60 Parallel Duplex to bend along its major axis—if you can! You'll discover that you can't put a damaging wrong-way bend in this tough cable—and neither can obstructions on the floor of your mine.

NO DAMAGING BEND—JUST A FLIP-OVER. When flexed in use, Rome's Duplex flops over and bends on its minor axis. Its interlocked construction forces the change and causes a flip-over, not a breakdown. This means that the power keeps coming through, and your coal production remains high.



WHAT HAPPENS TO OTHER CABLES. Wrong-way bends on ordinary shuttle car cables often cause conductors to slip, causing distortion. One side of the cable may stretch, the other crimp. Result: a weak spot. Further flexing, tension, or twisting turns the weak spot into a breakdown. Coal production then falls behind.

Send for your FREE sample! Put a two-foot sample length through this same test yourself. See how Rome 60 Parallel Duplex simply can't be bent the wrong way. Ask your nearest Rome Cable representative for your free sample—or write to Department 502-B, Rome Cable Corporation, Rome, New York.



WHY ROME'S DUPLEX BENDS THE RIGHT WAY. Open braid around each insulated conductor forms a crisscross tread-like surface—one that won't slip. The tough Neoprene jacket and braided conductors, meshed together, bend just one way. The interlocked construction assures the right bend, and power keeps coming through.

ROME CABLE
CORPORATION



With the present shipped output from the mine of 5600 tons, the recovery from the dense media washer is 510 tons per day

Salvaging Coal From Washery Rejects

In an effort to stabilize the quality of the product and to recover good coal in the refuse, this company installed a dense media washer at its preparation plant. All phases of the new operation are discussed, and cost data are given to show benefits obtained

THE Widen mine of Elk River Coal & Lumber Co. began operations in the lower Kittanning seam in 1911. The mine is served by the Buffalo Creek & Gauley R.R., Co. and the B. & O.

Records show that about 28,000,000 tons have been shipped from this mine.

Seam Difficult to Wash

The lower Kittanning coal seam here will average 8 ft in thickness with about 30 in. of parting. The top is generally sandstone and is easily held

with timbers. The seam is characterized by many irregularities.

When properly prepared the lower Kittanning seam is of excellent by-product quality. This fact has led to a long history of mechanical cleaning at the plant.

The present cleaning plant consists of two jigs: one Jeffrey Diaphragm and one Link Belt Simon-Carves six-cell air pulsated jig.

The seam may be classed as difficult to wash, particularly since the advent of mechanization. It had long been felt that cleaning efficiency suffered when quality had to be maintained at

a high rate of production. This fact led the management to make a thorough study of the washery rejects, to seek ways of stabilizing the quality of the product and to recover the good coal in the refuse.

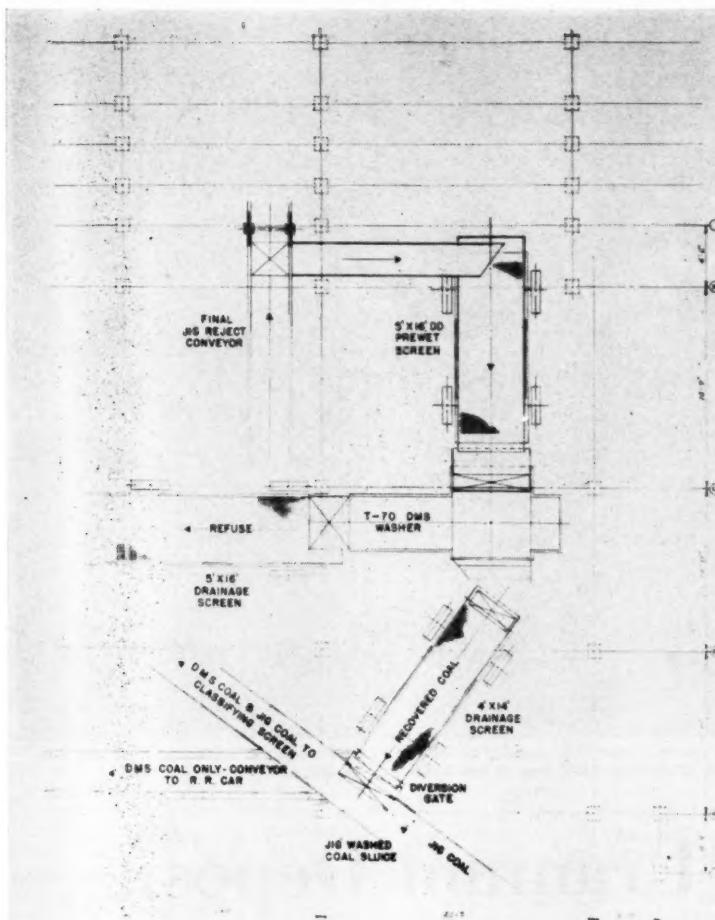
Facts Concerning Rejects

Tests made revealed that the refuse from the jig washers contained 12.5 percent float material at 1.45 sp gr. The dry rejects from the lump picking table were found to be practically pure slate. (See Table I).

For a production of 4385 tons, which was the production on the date of the test, the wet refuse amounted to 3285 tons. The loss of good coal, float 1.45, was calculated to be 413.3 tons. Greater production would naturally result in greater loss of good coal.

Since the loss of good coal was mainly from the jigs, any salvage scheme would entail handling this material.

By H. L. BEATTIE
Vice-President
Elk River Coal & Lumber Co.



General Plan—The recovered coal from the clean coal drainage screen may be conveyed to railroad cars for separate loading or discharged into the clean coal sluice with the jig coal for screening and loading in different grades, in the conventional manner.

costing less than \$100,000 is to be charged off at a rate of \$40 per day.

Other Benefits

The savings discussed represent tangible factors on which there can be no doubts since they are based on facts. There are, too, some intangibles which ultimately affect cost but do so indirectly.

One of these concerns the ash of the jig product. Before the reclamation scheme was installed the jigs were hard pressed to deliver a salable product under overload conditions except at a great sacrifice in loss of coal.

At present the shipped product is made high quality at all times. The loss in good coal is no longer a factor since it is all recovered.

As a direct consequence of this feature the complaints formerly received from some quarters have completely disappeared.

Another notable benefit is due to the increase in feed per hour to the

plant. Formerly it was difficult to load 4500 tons in one day (shipped basis). Now the dumping has been accelerated to the point that a production of 5600 tons is average and 6000 tons has been attained.

To better evaluate what this has meant, suffice it to say that in June when the salvage plant first went into operation the production per payroll man was 7.6 tons. Now it is 10.2 tons per man.

This required new planning and other improvements for which management must take credit. Even so it is not difficult to realize just how important a role may be attributed to the reclamation scheme.

Cost of Dense Media Plant

For the sake of economy the new addition is of wood construction, as indeed is all of the old washery. Steel beam supports for all the floors and machinery were provided. All fabrication such as hoppers, sumps, beams,

sluices, conveyors and wiring was done by local mechanics, as was the installation of the machinery.

A competent company engineer, Mr. E. R. Ketchka, working with Mr. A. F. Castanoli, Consulting Engineer of Huntington, W. Va., had charge of the installation.

The complete cost of the recovery scheme was under \$100,000, including the cost of the washery and machinery furnished by the Daniels Co.

The cost is modest when one considers that the investment is repaid every two months.

Some Adverse Factors

It has been mentioned that the production has been stepped up from 4500 to 5600 tons per day. All operators are acquainted with the stream pollution laws. The increase in production of 25 percent increased the stream pollution by that amount. The upshot has been that in order to retain what has been gained it has become necessary to make another sizable expenditure in still another direction, that of stream clarification. As a result Buffalo Creek pollution has been completely cleared.

A new settling tank 60 ft long, 10 ft wide and 10 ft deep, of about 31,000 gal capacity, receives all the waste water from the preparation plant. The solids recovered from this tank amount to about 400 tons per day. At present these solids are being loaded with the refuse, but plans are being considered for their recovery in the future.

All water entering the washers is fresh, either make-up water or water that has been clarified.

One compartment of the settling tank receives all of the overflow, whatever be its source. The excess water is pumped away by two centrifugal pumps, connected in series. The discharge point is behind a high "red dog" dike in front of an old abandoned mine.

Water clarification is accomplished by the filtering action of the "red dog."

This system is successful and the water entering Buffalo Creek is crystal clear and meets the approval of the West Virginia Water Commission.





The expansion program being completed this year will raise the capacity of the plant from its original design of 1250 tons per day to a capacity of at least 1650 tons of ore treated in 24 hours

The Gunnar Uranium Deposit Lake Athabasca

From discovery to production in 38 months—that was the good record achieved by this company. The entire operation, from early exploration to new projects under way this year, is described in detail. Unusual conditions such as air and water transportation and extremes in weather (88° above to 55° F below zero) are described

LATITUDE 59° 23' N., longitude 108° 53' W., pinpoints the area which was prospected and where 12 claims and seven fractional claims were staked on July 7, 1952, by Albert O. Zee-mel and Walter J. Blair for Gunnar Gold Mines Ltd. This discovery initiated a fast moving development and construction program which resulted in the outlining of an important uranium deposit with an estimated value in excess of \$130,000,000; the expenditure of \$20,000,000 for the construction and installation of a mining and

treatment plant; and the bringing into production of a 1250-ton treatment plant with the first drum of uranium precipitate rolling off the production line on September 9, 1955. Production from the treatment plant has been continuous since that date, and the importance of the operation can be gauged by the fact that its production at full capacity almost doubled Canada's former rate of uranium production. The expansion program being completed this year will raise the capacity of the plant from

its original design of 1250 tons per day to a capacity of at least 1650 tons of ore treated in 24 hours.

When the importance of this discovery was finally realized, it served to stimulate the tempo of the search for uranium, first in the Beaverlodge area, and then along the southern edge of the Precambrian Shield to the Blind River area in northwestern Ontario and on to the Bancroft area in eastern Ontario. The results of this intensive activity can be appreciated from a recent announce-

By J. N. BOTSFORD
Mine Manager
Gunnar Mines Ltd.

ment that Eldorado Mining and Refining Ltd., which is a producer itself and which acts as the procurement agent for the Canadian government, has negotiated contracts or issued letters of intent for the purchase of uranium precipitates valued at \$1,285,327,600. It is estimated that, with the expanded and anticipated contracts still to be completed for delivery by March 31, 1962, the total value of Canadian contracts will approach 1½ billion dollars from a combined daily milling capacity of 42,800 tons.

Location

Gunnar Mines Ltd. was originally incorporated as Gunnar Gold Mines Ltd. under the laws of the Province of Ontario by letters patent dated October 27, 1933. In addition to the uranium property, the company's present holdings include gold and chromite properties in the Province of Manitoba and gold properties in the Provinces of Ontario and Quebec. Thus it was felt the former name was misleading, and by supplementary letters patent dated March 10, 1954, the name of the company was changed to Gunnar Mines Ltd.

The Gunnar uranium property is comprised of the ED-BON group of claims and the ARCH and EJW groups of claims and fractional claims covering a total area of 1317 acres. This property is located on the north shore of Lake Athabasca in the extreme northwest corner of the Province of Saskatchewan. Lake Athabasca is 200 miles long and from 10 to 30 miles wide, and is one of the large lakes of Northern Canada. It forms a part of the Mackenzie River drainage system which is navigable from the end of steel at Waterways, Alberta, down north for 1500 miles to the Arctic Ocean. The property is somewhat isolated, being 450 air miles north northeast of the City of Edmonton, Alberta, and 250 miles from the end of steel. Access to the property is by aircraft only for personnel and light freight, and by tug and barge during the summer months for the transport of heavy equipment and bulky supplies.

The exploration and early development of the property and its subsequent attainment to the status of a uranium producer has meant not only the development of an open pit mining operation and the construction and operation of a complete treatment plant, but also the establishment of a partially independent community of about 800 persons. This community has, of necessity, been serviced by its own aircraft and airport; has been provided with living accommodations, either as bunkhouses, apartment houses, or private homes; has been provided with a hospital and medical service, a school, and facilities for religious worship. New

projects under way this year will supply further living accommodations and an expansion of recreation and shopping facilities. We are also putting into operation the first units of a water transport system for the handling of our own freight.

Three Main Rock Types

The geological formations in the mine area are mostly Precambrian metasediments striking approximately N. 75° E., and dipping at 45° to the south. There are three main rock types in the area. The lowermost, which occupies the northwestern portion of the claim group, is a fine-grained, quartz-feldspar paragneiss. Overlying this to the south and east is a coarse-grained granite gneiss. The third main type is economically important, since it forms the host rock for the ore, but it is also unusual since it approaches a syenite in composition, but contains considerable amounts of carbonate. Various names have been applied to this rock such as soda granite, carbonated syenite, albite monzonite, and "sponge rock" or "rotten granite" (due to its characteristically pitted and weathered surface). However, we have now applied the term "syenite," and it is to be noted that it differs from the granite gneiss only in the presence of calcite and the corresponding absence of quartz. In addition to these three main types of rocks, there are minor amounts of pegmatite and of dark colored rocks which are locally called "mafics."

All rocks of the area show evidence of brecciation. The intensity of the crushing is not uniform as the granite shows less deformation than the syenite, and the crushing is stronger and more widespread in the ore bearing part of the syenite than in its non-mineralized counterpart. The greater resistance of the granite to this deformation is probably due to its higher content of quartz. The localization of the more intense crushing in only part of the syenite appears related to the size and shape of the orebody.

The "A" orebody lies almost wholly within the northeast corner of this large, well-brecciated, irregularly-shaped mass of syenite. Smaller patches of ore are also found in adjacent, smaller syenite bodies, and a small amount of ore has been found in the granite gneiss, which occurs as remnants within the syenite or contiguous to it. There appears to be a general relationship between uranium values, amount of brecciation, and the intensity of hematite staining, but ore boundaries are established with certainty only by radiometric assays.

The ore minerals are pitchblends, which is disseminated throughout the brecciated syenite, and its alteration product uranophane. There are prac-

About the Author



J. N. BOTSFORD graduated from the University of Toronto in 1933 with a B. Sc. degree in mining engineering.

He has held the position of mill superintendent (1936-1942), Gunnar Gold Mines Ltd., Beresford Lake, Manitoba, Canada; assistant mine manager (1943-1945), Eldorado Mining and Refining Ltd., Port Radium, Northwest Territories; mine manager (1946-1952), Ogama-Rockland Gold Mines Ltd., Long Lake, Manitoba, Canada.

Botsford became mine manager of Gunnar Mines Ltd., Uranium City, Saskatchewan, Canada, in 1953.

tically no associated gangue minerals. The ore and most of the surrounding rock is stained red with hematite, and the colors may range from light pink to brick red.

The shape of the orebody resembles a massive pipe which plunges southward from the surface at 45 degrees for a known length of 1400 ft. Its diameter near surface is about 450 ft. At a depth below 300 ft there is a distinct flattening and an offsetting of the pipe which then resumes its original shape and continues its southward plunge beneath Lake Athabasca. The upper portion of the pipe down to the bottom of the offset will be mined by open pit methods, while the remaining lower ore, which is protected from the lake by a 400 ft thick sill, will be removed by underground mining methods.

Early Exploration

Preliminary diamond drilling with inclined holes recovering "E" core commenced in October 1952, and it was realized before Christmas of that year that a full diamond drill campaign was required immediately. This program of drilling vertical holes on a square grid pattern at 75 ft centers commenced January 31, 1953 and continued until March 19, 1954. During this time 179 holes were completed for a recovery of over 70,000 ft of "A" core. The results of this diamond drilling program indicated that the size of the deposit was larger than originally anticipated, and plans were

changed accordingly to enlarge the capacity of the treatment plant from 750 to 1250 tons per day. This drastic change immediately necessitated the complete revision of all our original plans for accommodations, location of treatment plant, and the time of construction commencement. It was evident that advance equipment, which would be required for an early start on overburden removal from the open pit area, and for rock removal from the new treatment plant location, must be placed on the property well ahead of the arrival date of first water freight in early June. Thus an air lift was arranged and landing facilities were prepared at the property by the construction of an ice landing strip for heavy aircraft on the ice of St. Mary's Channel. The air lift commenced on March 4, 1954, and continued through until May 11, with our own aircraft completing this work at that date. During this period 457 tons of machinery, equipment and supplies, including tractors, scrapers, trucks, a crusher and conveyor, and a one-yd diesel shovel, were flown

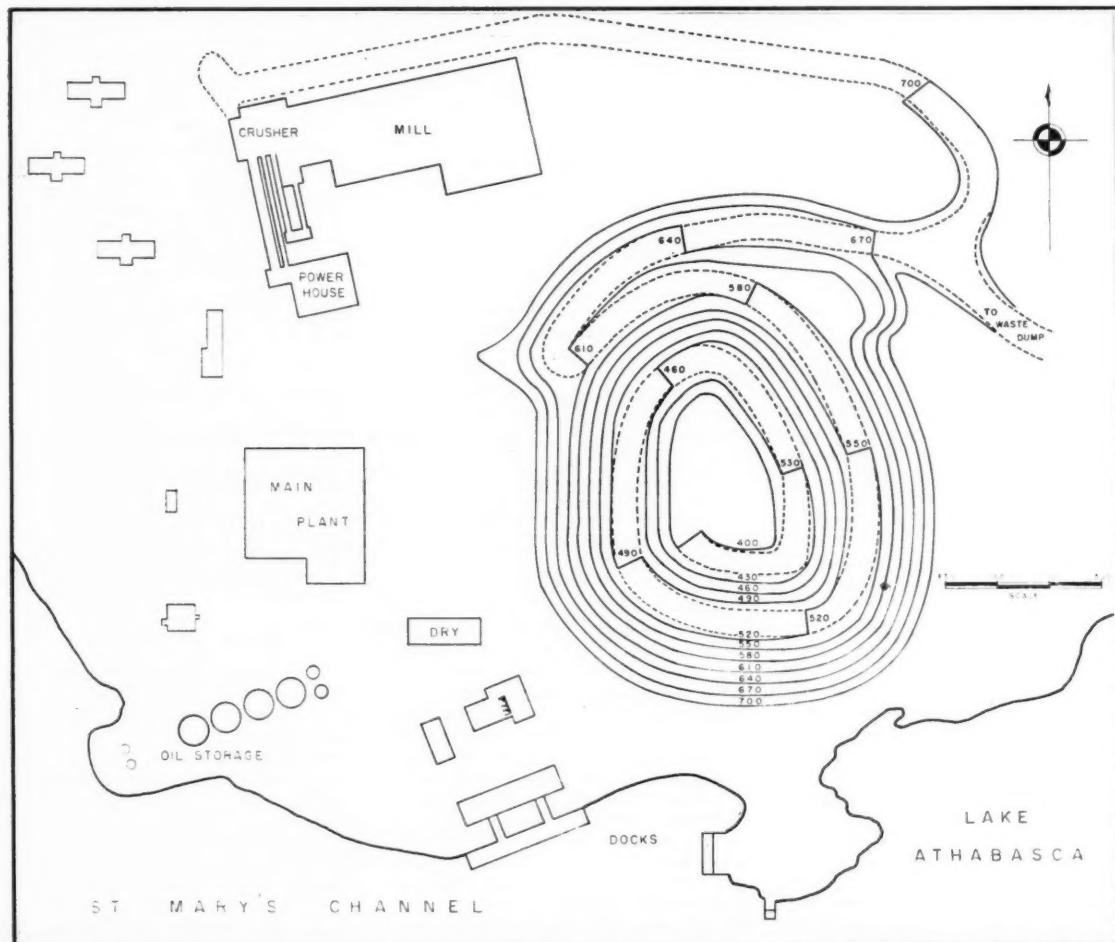
from Edmonton or Waterways to the property.

Open Pit Development

Development of the open pit involved the removal of 353,000 cu yd of overburden and 900,000 tons of waste rock capping. This overburden included a top covering of two or three ft of muskeg and from 20 to 60 ft of glacial till or rock flour, the removal of which gave considerable trouble. The glacial silt in situ was impervious to moisture, but when agitated with an excess of moisture present became a heaving mass which would not support mobile equipment. It was also found that beneath the muskeg covered areas there were frozen silt and lenses of massive ice. Removal of the overburden revealed tongues of crystal clear ice which, on occasion, were ejected by the pressure of the surrounding overburden into the open face of an excavation. Whether these frozen areas were permafrost or remnants of glacial ice remains a debatable point. Nevertheless, these frozen areas could not be

moved by dragline or monitor until they had thawed, and when thawed, sloughed and flowed to the lower excavated areas. During the early planning stages, serious consideration was given to removing this glacial silt by hydraulic monitors, but a check of diamond drill hole surveys indicated the configuration of the bedrock surface of the pit area did not lend itself to this procedure. Preliminary metallurgical tests had shown that this rock flour would cause excessive sliming in the treatment plant thickeners, and it was arranged that final cleanup of overburden over the ore areas of the pit would be completed by hydraulic monitor. Thus a combination of methods was used in the overburden removal combining tractors and scrapers for muskeg and top burden, a Marion 101-M shovel converted to a 2½-yd dragline working in conjunction with 36TD Euclid trucks, hydraulic monitors, and finally, when rock benches had been established, three cu yd shovel fronts and Euclid trucks.

The southern rim of the open pit



Plan of Gunnar open pit—Dotted lines indicate the roads which have been planned 50 ft wide with grades never exceeding eight percent

is within 100 ft of Lake Athabasca, and the pit will lie almost wholly beneath lake level. During the diamond drilling campaign only a few of the deepest holes made water, and analyses indicated this water to be markedly different in composition from that of the main lake. Most of the minor faults encountered were gouge-filled and dry, and we have been encouraged by operations to date that no serious water problems will be encountered. At the surface the pit opening is about 1000 ft long in a north-south direction and approximately 800 ft wide. Most of the walls are in granite gneiss and the ground is very competent. The north wall follows the footwall of the ore. The waste is confined to the south end of the pit, and this waste mass diminishes quickly with depth. The waste to ore ratio over the entire pit has been calculated at 2.4:1. Rock removal has been planned in at least ten benches leaving a 21 ft berm and a 30 ft vertical face, with a resultant wall angle of about 55°. Roads have been planned 50 ft wide with grades never exceeding eight percent, and they will spiral up the walls around the pit. Total length of travel from pit bottom to crusher slip will be about one mile.

Drilling Performance

Surface rock removal of more than 1,000,000 tons was required for the preparation of benches in the open pit area and excavations for the mine building and treatment plant foundations. The rugged terrain and continual moving demanded a light, mobile drill capable of substantial production, and we used six I-R X72 wagon drills equipped with tucker hoists. Compressed air was supplied by I-R Gyro-Flo 600 cfm mobile compressors. The drill steel was 1 1/4-in. diam made up on the job in 9, 18 and 27 ft lengths and fitted with two-in. tungsten carbide bits. Blasthole spacing ranged from four ft by four ft to five ft burden by six ft spacing with two ft of overdrill to maintain grade. Fragmentation of this surface capping was not always good since frost fractures caused considerable overbreak.

As soon as the original surface had been reduced to elevation 700 (datum level: Lake Athabasca—700 ft) and benches firmly established, the heavier production drills were moved on to the job. The first such units used were two Gardner-Denver No. 123 Tower Drills. These are 4 1/2-in. piston machines with ten-ft towers using eight-ft lengths of 1 1/4-in. hexagon drill steel with ring-seal shank and 1 1/4-in. couplings. The use of the Type 06 tungsten carbide bit, which fastens directly to the shank of the drill steel with a reverse buttress thread, has given very satisfactory service. The



The importance of this operation can be gauged by the fact that its production at full capacity almost doubled Canada's former rate of uranium production

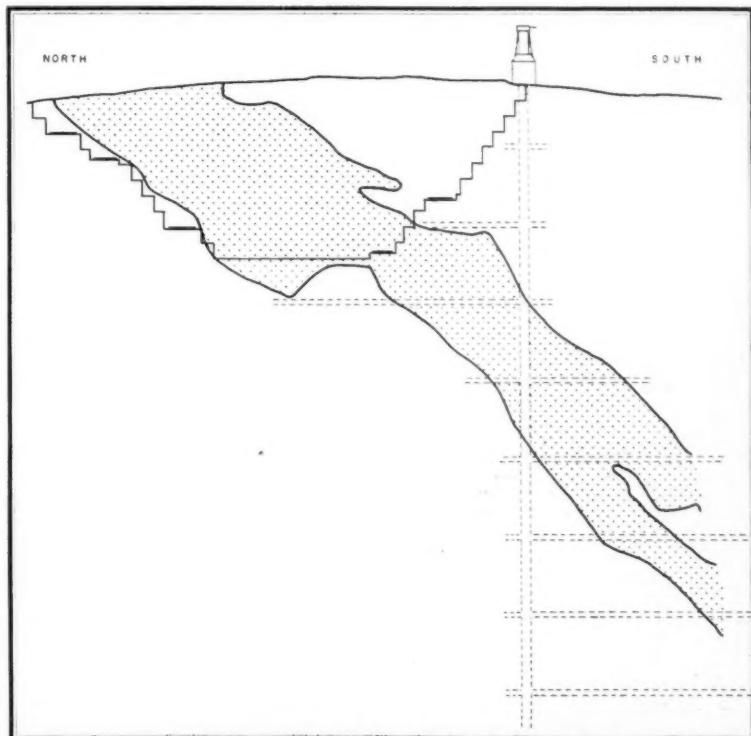
performance of these drilling units, especially in the warmer seasons of the year when no special protection need be afforded the drill operators, has been as high as 30 ft per hour of 4-in. diam hole drilled in ore. Recent experimental work with a new Sandvik tungsten carbide bit has shown promise of definitely reducing drilling costs.

During the summer of 1955 we put into operation three Ingersoll-Rand DM2-0HD500 Drillmaster drilling units with "Power-Master" out-of-hole drills. These are a self-contained, self-propelled, crawler type drilling unit incorporating a DR-600 Gyro-Flo rotary compressor, hydraulic jacks, dust collector, air hoist, hydraulic wrench, and closed operator's cab with con-

trols. Rigidly mounted on the chassis are two vertical members supporting a self-raising drill guide to accommodate a 25-ft rod change, feed motor, rotary head, and rod changer. The 2 3/8-in. hollow, round drill steel has an average life of 2000 ft before reconditioning. The four-in. tungsten carbide bits are sharpened every 35 ft and have a life of 1000 ft. Average drilling speed has been 19.8 ft per hour.

Explosive Consumption Reduced

Blasthole burden and spacing is currently 8 ft by 8 ft in the ore, and 9 ft by 10 ft in the waste. Explosive consumption is gradually being re-



Longitudinal section of the Gunnar "A" orebody

duced below 0.9 lb per cu yd. A normal blasthole load is four 3 by 16-in. cartridges of 75 percent Gelatin Forcite loaded and tamped in the bottom of the hole and topped by three cartridges of 75 percent Semi-Gelatin, which is a less dense and cheaper explosive. The balance of the hole is deck-loaded with Free-Running 65 percent Ammonia dynamite to within three or four ft of the collar. Drill cuttings are used for decking and stemming. Reinforced Primacord, fired by individual millisecond delay detonators, is used to ensure complete detonation of decked holes. Experimental work is continuously being carried on with various types of explosives, methods of loading, and bottom detonation.

Secondary drilling and blasting for oversize or high pit floors is accomplished by the use of pluggers or low velocity powder.

Loading Equipment

The loading equipment consists of two Marion 101-M diesel shovels with 300 hp Cummins engines with torque converters and three cu yd buckets. A third similar unit is being put into operation this year. The haulage equipment consists of nine Euclid trucks, Model 36TD, with 14.8 cu yd heated dump boxes. There are two D-6, one D-7, and one D-8 Caterpillar bulldozers in use for pit floor clean-up, and one No. 12 Caterpillar grader for haulage road maintenance. There are, of course, the usual service trucks and fuel wagons for the servicing of this equipment at the job site. Current tonnage from the open pit is about 35,000 tons of waste and 11,000 tons of ore per week.

Sampling Procedure

During the early pit development it was difficult to obtain accurate blasthole samples from the cuttings of the Ingersoll-Rand wagon drills, and all blastholes in or near the ore were checked with a geiger probe, using an Electronics Associates No. EA191 drill hole geiger. These readings were recorded at five-ft intervals. A successful and accurate sampling procedure has been developed in conjunction with the dust collection system installed on the Ingersoll-Rand Drillmaster drills. The cuttings and dust collected from the total depth of a blasthole, exclusive of overdrill, is discharged into a hopper on the side of the drill unit. These cuttings are raked from this collection box directly into a Jones riffle, which was especially made to accommodate the full length of the hopper. This sample is further reduced by riffling until it weighs between three and four lb, and is then bagged and checked in the sample room for preliminary estimation purposes. This preliminary assay

work is done with a Canadian Aviation Electronics scintillometer, Model 963. If preliminary results warrant, the samples are then sent to the laboratory for radiometric assay. Where considered necessary, the blastholes are probed at five-ft intervals. The plotting of the assays of all blastholes drilled in ore provides an accurate control so that uniform grade of mill feed can be maintained. Faces are presently being checked with a Universal Atomics Corp. Model UAC-411 Gun Type Geiger with an open end window tube in the barrel of the gun. This work is being done in anticipation of checking future underground development faces.

Underground Development

Completion of the original planned construction program of 1954 within the schedule of time and cost estimates made possible the advancement of the sinking of the underground shaft by one year. This three-compartment vertical shaft consists of a large cage compartment, a full skip compartment and a manway compartment, with an over-all size outside the timbers of 25 ft 4 in. by 7 ft 8 in. It has been sunk to a vertical depth of 1242 ft, and eight levels complete with lip pockets and the main loading pocket have been established. Our plans call for the erection and installation of a 125-ft steel headframe with two 1000-ton rock bins and a 120 by 60-in. double-drum electric hoist before the end of this year. Following the completion of these installations underground development work will proceed immediately.

Metallurgy and Treatment Plant

In August 1953 preliminary ore samples from split diamond drill cores covering the open pit and some of the future underground ore were forwarded to the Bureau of Mines, Ottawa, Ontario, for metallurgical test work. This was followed in the same month by a 50-ton bulk sample obtained from an outcrop in the center of the future open pit area. Gunnar Mines was the first private company to require test work for process application and plant design, and I wish to record the excellent cooperation the Gunnar metallurgists received from members of the Bureau in the pilot plant scale test work. Preliminary tests for both acid and alkaline processes were carried out, and the acid-sodium chloride process was selected for the dissolution of the uranium. Various methods of recovering the uranium from solution were investigated, and following considerable test work and study, the ion exchange process with magnesia precipitation was selected. It is noteworthy that this process was introduced to

the Canadian mines through Gunnar test work.

Design of the present mill started in October 1953, and the ordering of structural steel and major equipment was essentially completed by August 1954. Excavation, concrete work, steel erection, building siding and roofing, and equipment installation were finished by August 23, 1955. The plant commenced operation on this date, and the circuit was filled and the first drum of precipitate produced on September 9, 1955.

The Gunnar mill, including the crushing section and the laboratories, is enclosed in a structural steel building 550 ft long, 160 ft wide, and from 40 to 80 ft high. The acid plant is a separate unit 500 ft northeast of the mill building. The plant was designed for simplicity and ease of continuous operation. Crushing for the original rated capacity of 1250 tons per day is on a one shift, six day week basis. Sufficient ore storage is provided within the mill for five days production. After primary grinding in a single rod mill the circuit is divided into two separate production lines. This permits metallurgical information to be gathered on a plant scale basis and also provides sufficient flexibility to maintain a high percentage of rated production in case of serious breakdowns or other unforeseen causes.

The crushing plant is of standard design and the equipment in operation includes a 36 by 48 in. Traylor jaw crusher, two 5 ft by 8 ft by 1½ in. opening Symons rod deck screens, two 4 ft by 8 ft by ¾ in. Symons rod deck screens, one 5½ ft standard and one 5½ ft short head Symons cone crusher, and the necessary conveyor belts which are installed at a maximum slope of 15°. A 1000 ton surge bin and 100 ton fines bin are included in the crushing circuit and facilitate the crushing and withdrawal of waste rock for construction backfill and road maintenance throughout the open pit and plant area. Dust control is effected by the use of three Sly dust collection units located in the main crusher house, the surge bin area and the ore bin storage area. These units have capacities of 15,000, 5,000 and 10,000 cfm respectively. All collected dust is eventually discharged to the rod mill feed conveyor.

Duplicate Production Lines

Primary grinding is done in a 9 by 12 ft Marcy rod mill and the discharge is split evenly between two 78-in. Aikens classifiers. From here to the final product processing is carried out in duplicate production lines, each having the same capacity. The following brief description covers one production line. The classifier sands are ground to 60 percent minus

200 mesh in a 9 by 10 ft Marcy ball mill in closed circuit with the 78-in. Aikens classifier, and the classifier overflow, after passing over a Dings magnetic separator to remove grinding steel, is split to two 50-ft three compartment Dorr thickeners. Thickening to 57 percent solids is aided by the use of the flocculating agent, Jaguar, and the maintenance of this density to the leaching agitators is assured by the use of two American disc filters which can be cut into the circuit, if and when required. The neutral thickener overflow is returned to the grinding solution circuit. Leaching takes place in six 20 by 20-ft Dorr type AA air lift agitators in series. The sulphuric acid is introduced into the primary agitator and the sodium chlorate into the second agitator. Retention time is 25 hours and the pulp is pumped to three Oliver string discharge primary filters and thence to three Northern Foundry string discharge secondary filters. The cake is then repulped with barren solution and discharged to tails. All filtrate is combined and sent to a clarification thickener, and the supernatant liquor is clarified to 50 PPM solids by a conventional Moore type leaf clarifier. The ion exchange equipment is a package unit supplied by the Permutit Co. and this system is under automatic control from a laboratory control room adjacent to the columns. Salt-sulphuric acid solution is used as the eluate, and the upgraded pregnant brine is precipitated in two 20 by 20-ft wooden precipitation tanks, each fitted with a Greely mixer. Magnesia, wet ground to minus 200 mesh, is manually added at a set rate, and complete precipitation occurs at the neutralization point. The precipitate is filtered in either a Sweetland or two plate and frame presses and after careful washing, each press load is dumped to a ten-ft diam steam heated rabble type dryer. After five hours of drying, the product is pneumatically conveyed to a storage hopper and then drummed in 30-gal drums which are double checked for weight, sealed, stenciled, and delivered to the Eldorado Mining and Refining Ltd. aircraft at the Gunnar airport.

100 TPD Acid Plant

The present acid plant was supplied by the Leonard Monsanto Co. and is rated at 100 tons of 100 percent sulphuric acid per 24 hours. It is a conventional contact type acid plant using elemental sulphur, which is supplied by the Royalite and Shell Oil Companies from the Turner Valley and Jumping Pound fields in Southern Alberta. Excess steam is used for the heating of plant and camp buildings. The production of sulphuric acid consumes between 17,000 and 20,000 tons of sulphur per year.

Laboratories

The laboratories, which occupy 3500 sq ft of the building space on the south side of the mill building, are equipped to handle radiometric analyses of ore, fluorimetric chemical analyses of mill products, and impurity determinations related to uranium production. There are approximately 100 analyses processed in the laboratories every day. Instrumentation is a very important and controlling factor in plant operations, and an instrument shop has been set up within the laboratory area. All the analytical work is handled by a chief chemist, an assistant chemist and nine technicians.

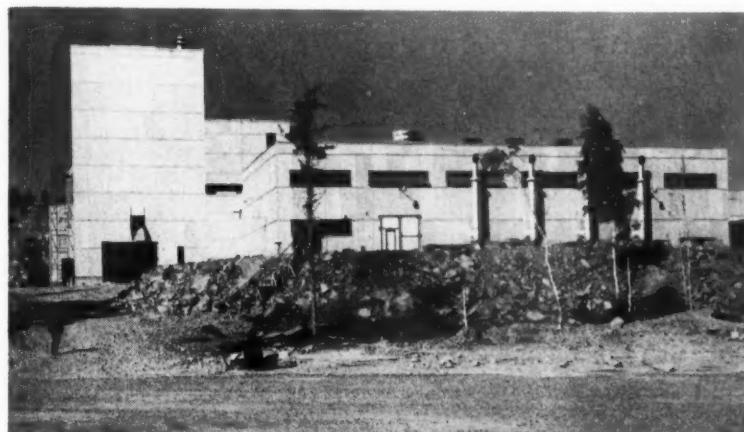
Plant Capacity Being Increased

Preparation of the flow sheet and design of the treatment plant by the Gunnar metallurgists was on a very sound and conservative basis as witnessed by the fact that the filling of

There are 45 hourly rated employees in the leach plant, seven men in the acid plant, and 14 maintenance men.

Camp Construction

The development of the open pit and the construction and operation of the treatment plant has necessitated the construction of many additional buildings and structures on the job. Electric power is generated on the property by five Nordberg Superair-thermal 1200 hp diesel engines, Type FS-136-HSC, which are directly connected to English Electric 2300 v, 60 cycle generators rated at 1056 KVA at 450 rpm with main shaft exciters. The exhaust gases from these diesel units are passed through Foster Wheeler waste heat boilers and produce 3000 lb of 50 psig saturated steam per hour per engine at full load. A 200 hp Dominion oil fired boiler supplements steam production in cold weather and a second unit of a similar size is being installed this year. The diesel electric generating



The diesel electric generating units, the high tension switch gear, the boilers, the high pressure air compressors, low pressure air compressors, and vacuum pumps for mill service are all housed in the power house

the new circuit and delivery of a product which met all specifications was completed in 16 days after introduction of the first feed to the grinding circuit. Over-all plant extraction has averaged 94.5 percent with a final recovery of 91.5 percent. Increase of the plant capacity by 32 percent is presently under way and this is being accomplished by the installation of a 42-in. Nordberg gyratory primary crusher, two leaching agitators, three string discharge filters, an Eimco Precoat clarifying filter, one precipitation tank, some additional pumping capacity, and a 65-ton Leonard Monsanto acid plant.

The men required for the normal mill operation consist of a mill superintendent and a staff of ten, including an assistant superintendent, mill engineer, foreman, and shift bosses.

units, the high tension switch gear, the boilers, the high pressure air compressors, low pressure air compressors, and vacuum pumps for mill service are all housed in the power house, and this building is connected to the treatment plant by an underground tunnel through which all these utilities are conducted. The plant service building, which covers an area of 53,200 sq ft, houses all the departmental workshops, garage, warehouse and offices. The mine dry house, which is capable of servicing 400 men, is of modern design and provides facilities for open pit and underground miners. Our fuel storage capacity is 1,610,000 Imperial gal of fuel oil and 70,000 gal of gasoline. Summer freight handling is over a main 32 by 244 ft dock and a secondary 32 by 60 ft dock. The dock

warehouse area covers an area of 10,000 sq ft. A ready-mix concrete plant of our own design was set up on the job early in 1954, and it has a capacity of 15 to 25 cu yd of concrete per hour which is delivered to any part of the job by dumpcrete trucks.

Accommodations at the present time consist of a cookery complete with a cafeteria, five permanent bunkhouses each with a capacity of 64 men, a staff house, three annexes, and smaller temporary quarters for construction crews. We have a seven-bed hospital which is equipped to handle all first aid treatments and minor operations. Private accommodations consist of a directors' lodge, 23 staff dwellings, a 16-suite apartment house, and 20 dwelling units for hourly rated employees. A second apartment house, 15 more dwelling units, a school, and a combined shopping and community center are being erected this year. All buildings on the property are of modern construction and are supplied with chlorinated water, electricity and steam heat from the central heating plant. The water, steam and sewage lines are connected to all buildings through wooden pipe boxes laid on the surface of the ground, since the presence of solid rock over most of the camp area and the absence of any depth of overburden or soil makes excavation of pipe trenches impractical. The pipes are wrapped together with a tough paper wrapper, the inside of the box is lined with a heavy building paper and the intervening space is packed with shavings. We rarely experience any trouble with frozen pipe lines.

Air-Water Transportation

It is almost impossible to evaluate the role which the airplane has played in the development of the north country, but it suffices to say that progress and development during the last 20 years has been equal to that of the previous 200 years in this part of the world. An airstrip had been constructed at Beaverlodge, Saskatchewan in 1951 by Eldorado Mining and Refining Ltd. to service its Beaverlodge operation. The operation and control of this airport was later taken over by the federal Department of Transport to handle the rapidly increasing volume of commercial and private air traffic into the fast growing community of Uranium City. However, since these facilities were 20 miles distant from the job and there was no overland transportation, it was imperative that we provide our own air transport and landing facilities closer to the Gunnar project.

We were fortunate in locating a sandy valley covered with jackpine trees two miles north of the operation, and this proved to be a suitable site for an airstrip. Preliminary

clearing was done in 1953 to assess the value of this location, and once its suitability was assured, a concentrated effort was made to develop this airport between July 26 and November 10, 1954. During this time an airstrip, which is 300 ft wide and 5600 ft long, was constructed and connected to the main camp by a two mile road. This airport is now provided with a proper taxi strip and refueling area and with a small airport administration building. Radio contact is maintained with Edmonton, Uranium City and neighbourhood properties. There is no road system to Uranium City or any other point in the area, and local travel is by boat or by float or ski aircraft.

Gunnar-Nesbitt Aviation Ltd., which is a subsidiary company, operates a Douglas C-47 aircraft, and during the year 1955 it transported 2617 passengers and 1,972,022 lb of air freight between Edmonton, Beaverlodge and the Gunnar airstrip. It is estimated that our air traffic will increase to 3000 passengers and 3,000,000 lb of freight per year.

The water route down the Athabasca River and across the lake provides the only other means of freight movement in the country, and this mode of transport is open from June 5 until October 15-25 of each year. The freight is moved by diesel tugs of up to 500 hp which push or tow barges of varying sizes. The type of barge presently favored in the North is of all steel construction and is 35 ft wide by 150 ft long and 7 ft deep with a carrying capacity of about 500 tons at a draft of four ft. These barges are primarily tankers which can carry a base load of liquid petroleum and also a deck load of equipment or package freight. The larger tugs normally handle two or three barges on a tow. The first freight arrived at the Gunnar property on July 4, 1953, and up until the close of the water freighting season in 1955 we had received 50,533 tons. We anticipate that our annual water freight will now average 35,000 tons per season. Commercial water freight service into the Athabasca district is presently provided by the Northern Transportation Co. Ltd. and McInnes Products Corp. Ltd.

Weather Conditions

The increased use of modern mechanical equipment in mining operations and military exercises in the far north has necessitated research into mechanical failures due to low temperatures and wind chill. Wind chill may be defined as—"the removal of heat from a body or surface due to the temperature, speed and physical characteristics of the air which surrounds or passes over it, and especially as affecting the mechanical properties of metals at low temperatures."

Temperatures in this area of Northern Canada range from extremes of 88° above in June to 55° F below zero in January. The recorded average day temperature during the summer months is 62° above zero and during the winter months is minus 10° F. Our freeze-up period extends from October 25 until May 15, and the ice on the main lake attains a thickness of four ft. We are located in a semi-arid region with an average yearly precipitation of about 12 in., including 24 in. of snow of low moisture content. Our location on the shore of a large lake affords no protection from an almost constant wind during the winter months.

Year round open pit mining at this latitude appeared to present some formidable problems at the commencement of this job, but previous experience with low temperatures provided us with sufficient knowledge to assess these problems, and two years of winter operations have now indicated there should be no serious difficulties which cannot be successfully handled. This experience has necessitated making a number of modifications to the standard equipment purchased for the job, and these with our suggestions which have been incorporated by the manufacturers in new equipment, have played an important part in reducing cold weather downtime.

Lubricants

Despite continued research and the excellent cooperation of manufacturers and distributors, satisfactorily and proven types of certain lubricants for extreme cold weather operations are still not available. For the sake of standardization the products in use and referred to herein are manufactured and/or distributed by Imperial Oil Ltd. We have found that hydraulic systems operate satisfactorily to minus 20° F, but at lower temperatures we have experienced considerable trouble with line blockage, starvation of hydraulic pumps and build-up of excessive pressures in discharge lines due to increased viscosity of the fluid. All hydraulic systems originally used Polar 41 hydraulic oil, but we have found Voltesso Transformer oil No. 35 more satisfactory at temperatures below minus 30°. We anticipate further reduction of our troubles by the use of Aviation Hydraulic Fluid Univis J-43, which has a pour point of minus 80° F. The use of Arox E.P. 40 rock drill lubricant during early development work at low temperatures was far from satisfactory, since this product has a high pour point and our hoses and machine valve ports were being continually plugged with slugs of hard oil. A low moisture content in the air during mid-winter permits the use of Marvelube 5W which gives improved lubrication and reduced

(Continued on page 133)

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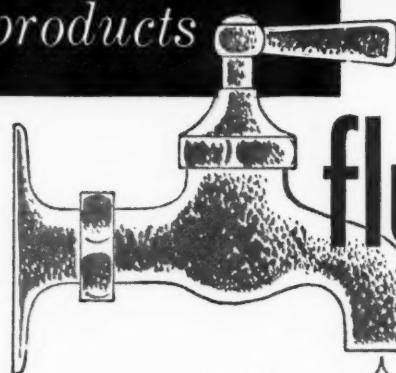
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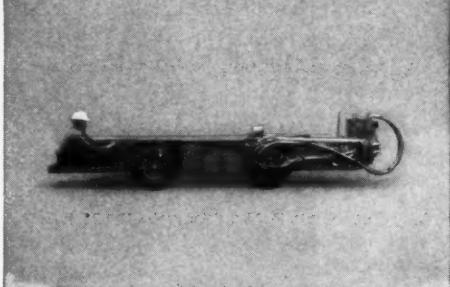
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THE ACME JUMBOLTER

Model
HSJ



FASTER AND EASIER!

Time studies have proven that under most mine conditions the ACME JUMBOLTER installs roof bolts 3 times faster than hand held machines.



• The ACME JUMBOLTER was designed to furnish a quick and easy method of drilling Roof Bolt holes where a mine is equipped with stationary or semi-stationary air compressors and having air piped to the working face. The unit is self propelled with full hydraulic drive and hydraulic steering. It is equipped with two stoper jumbo arms and is complete with

stopers and dust collectors. Cleveland Model S11, Model S12 or the popular new Model S20 stopers may be used. All equipment is Bureau Of Mines approved. Best operating conditions in seams 36" to 108" high.

We will demonstrate in YOUR mine. For more detailed information write or call —

LET THE MACHINE DO IT!

The ACME JUMBOLTER takes the heavy lifting and hauling out of roof bolting. Finger tip control positions the stoper at any desired point. Two stopers will cover any point in a space 23' 10" wide without moving the JUMBOLTER. Arms reach 9' in front of the machine and swing 270°. No blocking is required for uneven top. Ample space provided to carry the day's supplies.

ACME Machinery Company

WILLIAMSON, WEST VIRGINIA



The company has installed two-way radios in all of its stripping equipment to help shorten down time for most emergency repairs. The shovel crew can call the warehouse and get the necessary parts and repair crew on the way much faster

Maintenance of Strip Mining Equipment

Truax-Traer strives for maximum running time by taking advantage of all opportunities to apply preventive maintenance and by having the necessary parts on hand, ready to be installed. The importance of proper planning, light-weight dippers, alloy steels, Calrod heaters, maintenance tools and equipment, replacement parts and two-way radios are all discussed

STRIPPING is one of the governing factors of coal production, and maximum running time of stripping equipment is our aim. This calls for close cooperation between all departments, especially the mechanical and electrical departments, with one department taking advantage of the other's down time.

We plan our large repair jobs for summer months for three reasons. First—the weather is more favorable, second—more hours of daylight are available, and third—there is generally less demand for coal. Before starting a large repair job, we arrange to have a full pit of coal. Sometimes it is possible to complete one part of a repair job, then strip a few days to replenish our pit of coal before starting the second step. Large

repair or overhaul jobs must be planned several months in advance, with all new or replacement units assembled ready to be installed.

Most all of us are experiencing the same problem of trying to increase tonnage with our present stripping equipment. To help achieve this, we are replacing a 17 cu yd dipper with a new "T" steel 19 cu yd dipper and have already replaced a 30 cu yd dipper with a 33 cu yd "T" steel dipper. These new oversize, round lip, light weight dippers weigh no more loaded than the old style dipper when loaded. A careful study was made before these new dippers were ordered, and we are reasonably sure they will not contribute to any increase in our over-all maintenance. We are also expecting longer rope life

By R. M. LESENEY
Mechanical Superintendent
Truax-Traer Coal Co.

because these new round lip dippers load with less bail pull.

Preventive Maintenance

Under the heading, Preventive Maintenance, we place high-wall shooting well up on the list. We all know a well shot bank increases shovel output and reduces repair bills and down time for making repairs. The improvements that have been made in blast hole drills, both horizontal and vertical, have helped to reduce drilling costs. Sharp dipper teeth are next on our list, as any machine gets better yardage with sharp teeth. Crowd effort on shovels is reduced particularly on clean ups.

Dipper door snubbers are very important and should be kept working at all times. A banging dipper door on these large shovels sends a damaging shock throughout the whole machine. Although the shovel manufacturers are doing a better job of balancing these new light weight dipper doors, this problem must not be overlooked.

We find that Calrod heaters in our dippers are a big help in the winter, particularly when the digging does not have enough rock and shale to clean out the clay that freezes to the inside of the dipper. We feel that the heat helps keep the frost out of the steel itself and no doubt prevents

some cracks. By keeping the accumulation of frozen clay out of the dippers, it never is necessary to build a fire in or around the dipper, which saves delays and keeps the dipper capacity to a maximum. Calrod heaters in our round dipper handles is also preventive maintenance, and when the handles are warm they are much easier to lubricate during cold weather.

Another item that could come under preventive maintenance, is alloy steels. In most cases we are able to obtain better steel for shafts, gears, pinions and many other uses. The manufacturers are most cooperative along these lines.

Tools and Equipment

Two-way radios serve their purpose well. They are a time saver for personnel and help to shorten down

is the most useful tool a repair crew can have. The time and labor saved by a good derrick truck makes it a worth while investment.

With the price of labor and the short hour shifts we are now working, any power tool that will speed up the job is a sound investment, such as large and small impact wrenches and drills, both air and electric, and light weight lever chain hoists or come-alongs.

Hydraulic jacks are another time saver. One of our hydraulic jacks has a hole through the center. This jack is most handy for pulling out bushings, as well as pressing them in. With a 1-1/4 in. bolt thru the center and an assortment of different size round plates and washers we can handle most any bushing job. We also have a 100-ton hydraulic press that will handle gears up to six ft in diam-

this type lines up the parts without stretching the holes oversize. They can be driven through dozens of holes with a riveting hammer without swelling the ends.

Welding Procedure

When our round dipper handles crack or break, we stand the handle in a vertical position for welding. If the crack is on the upper end of the handle, we do the welding above the saddle block; otherwise we build a platform around the handle by tack welding some angles to the dipper handle at the proper distance below the break, so the welders can work in a comfortable position. This eliminates any overhead welding and offers a better opportunity to preheat and postheat. We can use two welders, one on each side of the handle. We then put a welder on the inside of the handle to burn out the crack, back to the sound weld and weld around the inside. This method saves removing and replacing the handle. These handle failures are generally in cold weather; so to keep our welders comfortable and efficient, we build a framework around the platform and form an enclosure by stretching tarpaulins over the framework. This also helps to shorten the welding time in bad weather.

We do not reverse our dipper teeth. The labor and down time for reversing is the same as for changing a set of teeth. After the teeth have been turned over, we have found from experience that they will last only a little over half as long as a new or rebuilt tooth, and then it requires almost three times as long to rebuild. It adds up to more welding time, more heat, and not as good a build up as when the teeth are used on just one side.

Cutting torches and welding machines are taken for granted. All the men in our repair crew and most of the shovel crew can use a cutting torch. On most jobs, welding time is quite important and when it is practical, we try to prepare the welding jobs with one of the repair crew so the welders can put in full time welding. We keep a cutting torch on all machines with a long hose that will reach most places.

Lubrication Important

Proper lubrication is also very important. We have built a grease warmer that holds two 120-lb grease drums. These containers are heated with Calrod heating elements and the temperature is thermostatically controlled to keep the grease at the proper temperature for best application, summer and winter. We buy all our greases in 120-lb drums. Our grease guns are nozzle filled by grease gun loader pumps which also form the cover for the drum, keeping out all foreign materials. This eliminates



Welders are kept busy between repair jobs building up dipper teeth and repairing spare dippers, dipper handles, dragline buckets and various other items

time for most emergency repairs, because the shovel crew can call the warehouse and get the necessary parts and repair crew on the way much sooner. We have these two-way radios in all of our stripping equipment, in our warehouse and office, and also in the cars and trucks of our master mechanic, electrical crew, and assistant superintendent. These mobile units with the two-way radios also carry fire extinguishers and first aid equipment.

We also have an Executone communication system on the wheel excavator, with one station in the operator's cab so that the operator can talk to the groundman, and also one station in the main machinery house close to the motor generator set starting panel.

A derrick truck with a power winch

and shafts 15 ft long, and a portable press of 50-ton capacity. With these two presses, we can take care of the majority of our press jobs.

We have a two cu yd dragline with a 70-ft boom that we use as a crane whenever it will shorten the down time on a repair job. We have swinging cranes over the swing machinery on the 950-B that are time savers when repairing a swing unit. Cranes and hoists for getting materials on or off the machines are most important. Swinging cranes and hoists over the welders' booths, drill press and blacksmith forge are necessary.

When castings or other parts are bolted together with drive fit bolts we have special drift pins made that are 0.002 to 0.004 in. undersize. These pins are soft on the ends and hardened in the middle. A drift pin of

handling the grease and keeps air pockets from forming in the grease guns.

Replacement Parts

At times it may seem we are a little extravagant on replacement parts, particularly if it will help shorten down time on repair jobs. We try to keep spare units assembled and will replace the entire unit when the down time is less for changing the unit than it is for repairing this assembly on the machine. By spare units, we mean such items as intermediate shafts with pinions, gears and bearings all pressed on the shaft.

We carefully inspect the used parts removed, and take into consideration the length of time they were in service. For example, if through experience we have learned the pinion is the first part of an intermediate shaft assembly to fail, we will not press a new pinion on the old shaft if there is any doubt in our mind the old shaft will fail before the new pinion. The same applies to gears and pinions in the swing gear and cat gear cases. Before any gears or pinions are reused, we carefully inspect the teeth for cracks by heating the edges of the teeth with a welding torch. We inspect the splines and shoulders on all shafts in the same manner before they are put back into service.

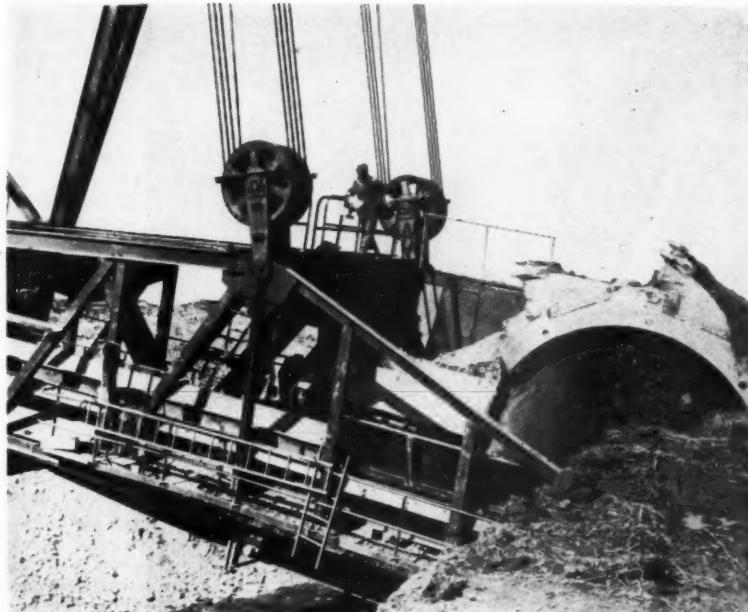
Repair Crew on Two Shifts

In our operation we have a repair crew on the first and second shifts. In most cases the second shift can finish the repair jobs started on the first shift, which helps to eliminate overtime pay. The second shift also helps prepare for the jobs planned for the next day. Quite often the third shift shovel crew starts to dismantle on their shift, which allows the first shift to commence re-assembling sooner, and if welding is the "bottle neck," we are able to get the welders off to an early start.

Our welders are kept busy between repair jobs building up dipper teeth, repairing spare dippers, dipper handles, dragline buckets and various other items too numerous to mention. The repair crews are always busy between repair jobs, getting spare units re-assembled and many things that will help out in any emergency break-down.

Belt Splicing—Specialized Job

The maintenance on our wheel excavator is similar to the repairs on any of our other stripping equipment with one exception, and that is belt splicing and repairing. We have our own vulcanizers, one for making splices and a small one for spot repairs. Belt splicing is a highly specialized job and we do not have enough



Except for belt splicing and repairing, the maintenance on the company's wheel excavator is similar to the repairs on any of its other stripping equipment

of it to keep men assigned to belt splicing and repairs like we do electric welders. Nevertheless, we had a training class put on at the mine by a representative of one of the belt manufacturers, and now enough men are trained to carry on a belt splicing or repair job around the clock.

In choosing men for the repair crew, we endeavor to select men we

think will work well in our stripping crews; then when possible, we promote these men to our strippers. We firmly believe with this background we develop better shovel crews.

In closing, we strive for maximum running time by taking advantage of all opportunities as well as having the necessary parts on hand and assembled ready to be installed.



Lubrication plays its important part in all phases of equipment maintenance



Control of roof by roof bolting has meant the continued operation of many mines and the recovery of coal hitherto considered unminable because of adverse roof conditions

Much thought has been devoted to improving bolting equipment and polishing bolting methods. Here, two authors—one a manufacturer, the other an operator—discuss advances in one of the newer mining arts



Roof Bolting Equipment

By ROBERT FLETCHER

Vice-President
J. H. Fletcher & Co.

THE ART of roof-bolting has been accepted by the coal industry with greater rapidity than any other mining change since the inception of mechanization. The reasons would appear to lie in the fact that it: (1) Increases safety as well as production, (2) Was encouraged by the U. S. Bureau of Mines, (3) Could be tried with a minimum of equipment.

Stopers or hand held face drills were generally used to drill holes in the mine roof during the development

of bolting. As the split wedge bolt was the first thought, and this required impact in setting, the majority of early machines were pneumatic hammers. Around 1950 the expansion shell began to gain favor as an anchor. It was about the same time that the first machines designed specifically for bolting were built.

Many improvements have been made in pneumatic and rotary equipment during the past six years. Greater stroke and more power has

been built into the stopers with increased capacity and flexibility through multiple arm mounts. Rotary drilling progress has benefited from improved carbide, bits, and augers, and a better understanding of the relation of feed pressure to speed of rotation in the drilling of the denser rocks. Both types of machines are striving for greater capacity, minimum labor, and automation. Many designs are now influenced by the continuous mining machine with which the bolter must often work.

Stopers

The principle and use of stopers is well known to the industry. They are supplied by Goodman Manufacturing Co., handling the Holman stopers, while Chicago Pneumatic, Gardner-Denver, Ingersoll-Rand, Joy, and Cleveland Rock Drill manufacture

Roof Bolting Equipment and Practices

models of their own design. Some mines prefer portable compressors, while others have centrally located compressor stations, piping the air to the face. A 150 cu ft compressor will operate most single units, with 250 to 275 cu ft minimum required for a twin installation.

Recently a rubber-tired, twin-armed Jumbolter, employing LeRoi Cleveland arms and stoppers, has been developed. The arms can be folded against the side of the unit when tramping and extended when drilling. Built into the unit is a dust collector system, drawing the cuttings through the center of the steel. The arms relieve the operator of most of the physical effort involved in moving the drill; in fact he can start the stoker, walk away, and be making up bolts while the hole is drilled.

Single Rotary Drills

The Chicago Pneumatic roof bolt drill is a 28 in. high machine especially adapted to low seams and close clearance. It is manually propelled,

signed to reach over obstructions on the floor, or into closely timbered faces. It can be operated by one man, and positioned while standing at the forward end of the boom.

The Fletcher Control Drill is the lowest (28-in. high) of several single head models. One electric motor drives a fully hydraulic system. While machines may be built for angle drilling, the normal model has a cross-slide for positioning on as much as 12 ft 6 in. centers across the entry. The telescoping mast is lowered before drilling, and gives a maximum feed in varying roof heights. Most machines carry the MSA dust collector. A drill guide aligns the auger for a straight hole. Rotational control is available for hard-rock drilling. Steering is by third wheel, with all wheels powered for tramping.

The Fletcher rigid mast drill, aside from the previously mentioned features, has a mast that is hydraulically wedged between the floor and roof before drilling begins. This assures steadiness where high thrust is used

chassis for track operation. Fletcher and Joy, likewise, have boom-type track machines. A combination rubber tired drill with track carrier car is manufactured by J. H. Fletcher & Co. It is designed for use in track mines having off-track loaders. The drill operates on tires at the face, then trams on to the carrier, automatically raising the ramps. The hydraulic circuit of the drill is then coupled to the carrier, and the car moves to the next face under power.

Two-Drill Machines for Greater Capacity

High production has in some cases required roof drills with greater capacity. The Joy twin boom unit is similar to the model previously described. Each drill and boom operates on its own hydraulic circuit, thereby eliminating any possible interference that one drill unit might have with the other.

One Fletcher model is specifically designed for working next to a continuous miner, such as a Jeffrey Col-Mol. Tramping controls are at the forward end, so the operator can handle both drills and maneuver the machines from the one position. Another Fletcher twin drill has slides for each head and gives high capacity with either one or two operators. All equipment, including dust collectors, is duplicated on a single chassis.

One way in which capacity may be increased on single drill machines is through the use of an impact wrench for tightening the bolts. This permits the machine to be used for drilling holes exclusively. A second man installs and tightens the bolts with a hydraulic wrench. Other attachments can be incorporated in the various machines, such as hydraulic face drills, and circular chain saws.

Improved Steels and Bits

Many of the advances made by roof drilling machines are the result of improved tools. While some few mines use carbide tipped bits in their stoker steels, the "throw-away" bit is by far the most prevalent.

A recent off-center bit has been marketed by the Cleveland Rock Drill Division of Westinghouse Air Brake Co. As the steel rotates, the bit drills a clearance hole, reducing sticking of steels.

New carbides, and bit shapes are now available for rotary drilling. The two prong bit, or one of a split type gives more rapid penetration in shales and softer type roofs. The size of the cuttings are larger, thus reducing dust. For sandstone, or hard materials, where high thrust is necessary, the apex style bit resists breakage to the greatest extent. This is especially true where a roof is lam-



Roof bolting increases safety as well as production

and employs direct motor drive through slip clutches for feed and rotation.

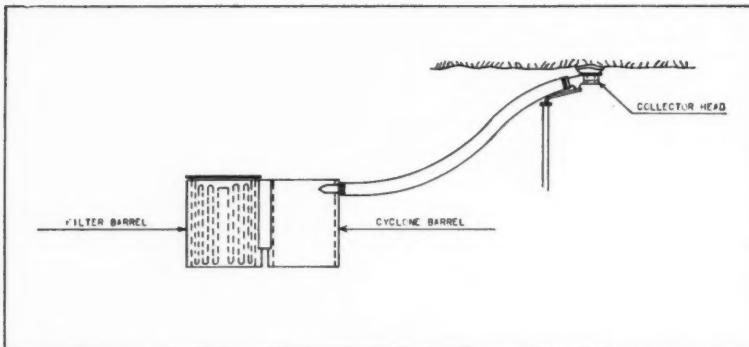
The Joy electric hydraulic rotary drill is a small, compact unit. It is adapted to various seam heights by furnishing masts of different lengths. Support for the mast is through hydraulic jacks, lowered to the floor. The dust collector is raised to the roof when drilling. The auger is guided for hole alignment. All motions are hydraulic, with instant control of drill speed and torque. Tram is through four-wheel, tractor-type drive, making it highly maneuverable in close clearances. It will drill angle holes and can be built to drill down as well as up. The mast may be turned sideward for "low clearance" tramping.

This same mast mounted on the end of a boom is another Joy model, de-

signed to drill hard rock, and also acts as a safety post, as the mast is not lowered until after the bolt is installed. The "F" model will wedge in 10 ft 6 in. of height.

The Jeffrey Roof Drilling Machine is a four wheel, electro-hydraulic unit. Positioning of the drill head is by means of a boom that swings 10 ft 9 1/2 in. to right or left of center. Support for the boom during the drilling operation is by means of a jack, lowered to the floor just ahead of the front of the machine. The dust collector head is on a trolley pole arrangement. The machine may also be provided with a built-in water drilling system, with tanks on the machine, and water fed into the hole through the center of the drill steel.

The Jeffrey Manufacturing Co. also builds a machine with similar boom and roof drill, but mounted on a



Dust collector—dry drilling generally involves the use of a dust collecting system

inated, and the bit breaks through strata of varying hardness.

The question is often asked "who makes the best bit?" The coal industry can be proud of the fact that all of the major tool manufacturers make excellent products. In choosing bits, consistency in the carbide should be demanded, but it may well be that the most important factor is not the bit itself, but the service man representing the manufacturer. It has been noted that in areas where service representatives follow their products to the mine face and work with the drill crews, the bit life is better, the cost per unit hole is down, and the productivity is high.

Drill steels are of a varied nature. Most stoper steels are of hexagonal drill rod. Rotary drilling steels may be of round drill rod, or of drill rod core with partial or full scrolls running the length.

For high rate of penetration in soft material it is generally found the scroll type auger gives the best results. Sticking of steels is eliminated, as the scroll acts as a positive conveyor for the cuttings. In some roofs the lead of the scroll is critical. With cuttings that readily powder, a close pitch, say $1\frac{1}{2}$ in. is best. With chips, a longer pitch, up to 3 in. works well.

It has been noted that the longer pitch has a tendency to throw the cuttings from the hole where a high rotation rate, over 500 rpm, is used. This increases the problem of dust collection.

Wet and Dry Drilling

Water-drilling, which is the application of water to the bit through a hole in the auger, is possible with machines of all manufacturers. It is the opinion of the writer that where a machine is capable of applying adequate thrust, and the drill rotation may be controlled, there is no advantage to water-drilling. Bit wear is directly proportional to the number of times the bit is rotated at any particular thrust in a given material. The water merely cools the bit, keeping the solder from melting. The bit won't heat to the point where the solder melts, if the machine is properly operated.

In fact, there are some observed disadvantages to water-drilling. The wet material falling into the moving parts of the drill unit, causes high maintenance and the operators work more deliberately due to the sloppiness of the procedure.

Dry drilling generally involves the use of a dust collecting system. With stoppers, air may be injected through

the steel to the top of the hole, with dust and chips passing through a collector head at the base of the hole into a bag or box supported on a nearby jack leg. The air is then filtered and released. The Holman and Cleveland stoppers collect through the steel with cuttings being drawn into a filter box by vacuum created through an aspirator.

The most widely used dust collector for rotary systems is manufactured by Mine Safety Appliances Co. It employs a collector head held at the base of the hole by any of a number of means. Approximately 88 cfm of air draws the cuttings into a pressure chamber, where the large materials fall out. A filter bag arrangement cleans air which flows to a positive type blower creating a negative pressure of as much as six lb. Discharge is through a silencer. This has passed Bureau of Mines tests when drilling a two-in. hole with two drills (a collector to each drill) at a rate of 12 fpm.

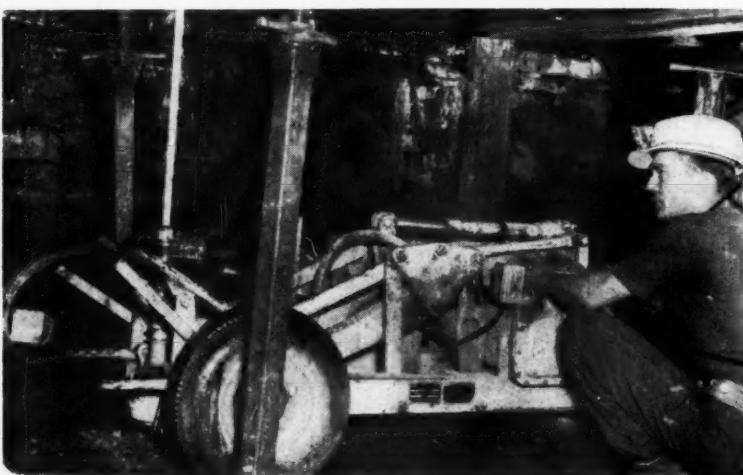
Type of roof strata is becoming less and less a determining factor in choosing between pneumatic or rotary drilling equipment. The latest stoppers, with movable mounts, are increasing capacity and reducing labor over former air methods. Rotary drills have the use of new carbides, more powerful machines, and automation to better their effectiveness in sandstone. But of most importance to all equipment is the increasing awareness of operating personnel that drilling must be systematized.

Supervision

Many mines are appointing one individual to be responsible for bolting. He first is the focal point for all manufacturers' representatives and can be primed by them with the latest developments in bolting. This may pertain to the bolts, plates, or shells; to the bolting pattern; to the tools; or to the machinery. He also checks the crews to see that the machines and tools are properly used.

Finally, he can establish programs, such as a bit record. As an example, by following this record it is possible to determine whether one operator is drilling correctly, the machine is in proper adjustment, or the right size and number of tools are being furnished. It is of help to the foreman in gaining the most from his men, and catches costs at the source.

Roof bolting is an individual problem to most mines. If special machinery is required, the manufacturers are prepared to build it. If special problems are involved, the State and Federal Mine Bureaus have always been anxious to help. To date, there has been rapid advance in this new science. With a number of years experience on which to draw, even greater benefits to production, and improved safety records can be anticipated.



Roof bolting is an individual problem to most mines

Roof Bolting Practices and Experiences at Jenkins, Ky.

By M. E. PRUNTY

Safety Director
Consolidation Coal Co. (Ky.)
Division of Pittsburgh Consolidation Coal Co.

SINCE the pioneer days of mining, roof control has been one of the chief problems that has confronted the coal industry. During this period of time many conventional systems of timbering have been developed with a limited degree of success. The greatest single contribution to a solution of this long-standing problem, undoubtedly, has been the development of roof bolting as a means of roof support.

Control of roof by this method has meant the continued operation of many mines and the recovery of coal hitherto considered unminable because of adverse roof conditions. The development of such a revolutionary method, of course, created many problems. However, through the combined efforts of agencies such as the Bureau of Mines, State Departments of Mines, progressive coal companies and manufacturers of equipment and supplies, these problems have been

and are being solved as they are encountered.

Effective With Weak Roof

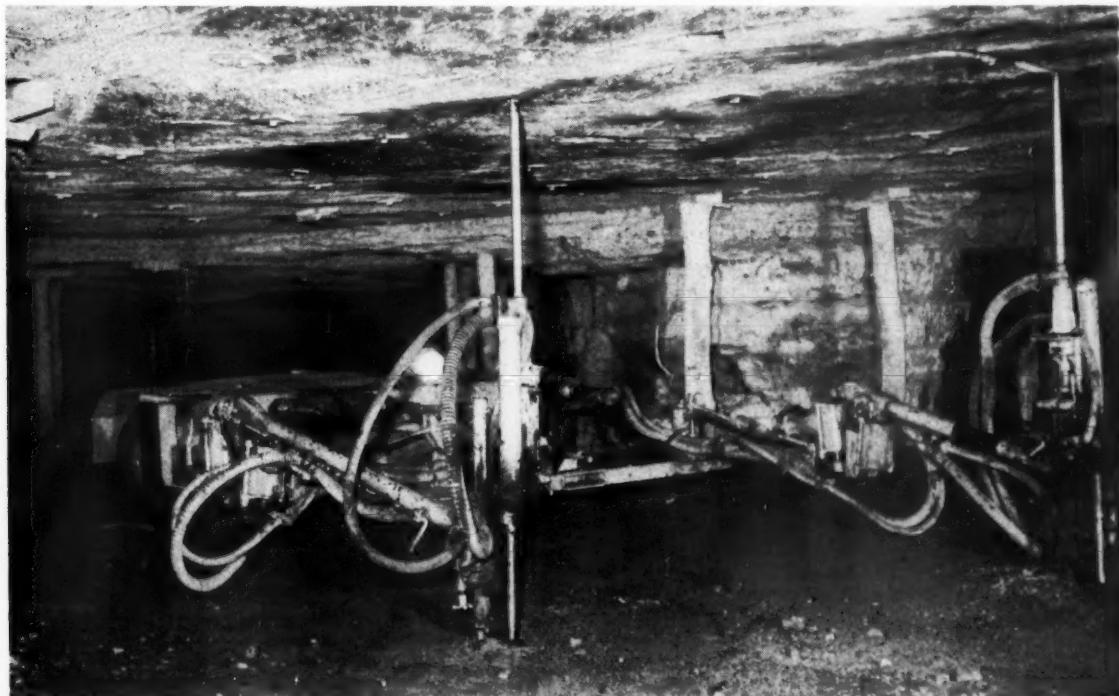
Our company, Consol (Ky.) was among the first to experiment in the use of roof bolts. The desire to do this was a necessity with us on account of the weak characteristics of the roof in certain areas of the Elkhorn No. 3 Seam, from which our production is obtained. Roof strata over this seam in our area consists of irregular layers of shales with occasional sandstone streaks. Over part of the area a hard sandy shale forms an excellent roof requiring only occasional use of supports. However, over most of the territory these shales were so weak the roof required extensive timbering, and in many cases the use of steel supports would not successfully hold it.

Our first experiment was with the slotted-type bolt which did a good job of supporting the roof but it soon became apparent that the cost of installation was going to be excessive on account of the additional equipment required to purchase and maintain and the time element of installing the bolts. These objections, plus a definite hazard from the bolts protruding from the roof, particularly in low seams, caused us to experiment with the expansion type shell for anchorage.

Standards Developed

After the experimental period, we were convinced that the expansion-type shell with 42-in. bolts and 6 by 6-in. plates tightened flush against the roof would provide a safe method of roof support, so in 1950 we adopted this standard and started 100 per cent roof bolting. This is still our basic standard, although as more and better materials become available, we have in some cases modified our bolt lengths and diameters as well as the bearing plate size. We are at present using bolts from 36 to 72 in. in length with diameters from $\frac{1}{2}$ to $\frac{3}{4}$ in. and 6-in. sq plates $\frac{1}{4}$ -in. thick.

Generally, before any change is made in a proven roof bolt assembly, we make adequate preparations in conjunction with the Bureau of Mines to place the new or modified units in a separate room or entry for testing and observation. In some cases, however, we place a few units in each



Many improvements have been made in roof bolting equipment during the past few years

working face during the regular cycle of mining, if individual tests before hand indicate that it is safe to do so. During the placing of these units, hole size and installed torque are measured, after which installed tension and maximum strength of the unit is determined by pull tests. If all of these tests prove to be satisfactory, the new or modified units are accepted for general use.

It has always been our policy after the testing or experimental period to establish roof support standards for the section or mine involved. This of course includes the supplemental use of conventional timbering where we consider it necessary. Examples of this are places of very light cover, such as near the outcrop, under stream beds, in extremely faulty areas, or where slips run parallel with the entry or room. A single row of posts is used in addition to bolts in rooms 25 ft or more in width and breaker posts are used along the gob lines where pillar mining is done.

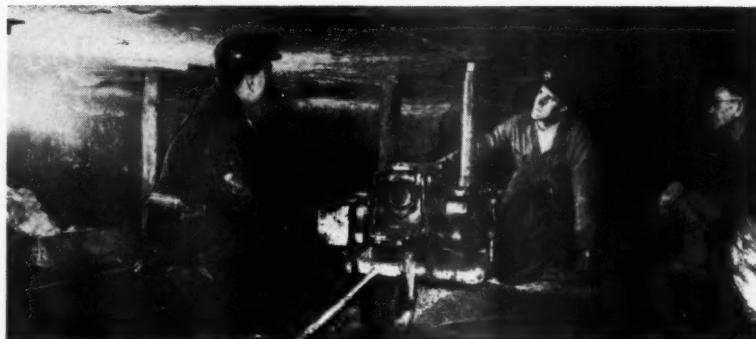
Bolting pattern is fixed at four-ft centers at right angles to the center of the place and at not over 4½-ft centers parallel with the center line. Where it is more than four ft from rib lines to the nearest line of bolts, additional bolts are required to be set. Since bolts are expensive, proper cutting and drilling of the coal is emphasized. As in the case of conventional timbering, additional bolts are to be set if the foreman feels they are necessary. Where bolting is done in previously timbered areas all of the loose material is scaled down first.

Wet Rotary Drilling and Dry Dust Collecting

Originally we used various home made devices to drill and install bolts, experimenting with both percussion and rotary drilling and both wet and dry methods of allaying dust at its source. It was soon apparent to us that rotary drilling wet was the most economical and the best for our particular situation because we already had equipment available that could be converted to rotary drilling without too much difficulty. This is our present method except for two machines that are equipped with dry dust collectors, which are particularly advantageous under some conditions.

A wide range of equipment is now available on the market that will, I am sure, do a good job if proper care in its selection is used.

The sequence of drilling and bolting with both wet and dry methods is practically the same. After the working place has been cleaned up, the bolter enters the place and examines the roof and sets two safety posts in by the last row of bolts. The section foreman then takes centers, extends center line to face, marks cut, and



Bolt is tightened by use of an extension wrench

measures off and marks bolt locations. The foreman allows very little leeway in marking locations as we feel it is usually better to insert an extra bolt than to deviate from the standard pattern. Since our bolting is mostly a one man operation, the bolter makes up several bolt assemblies while the foreman is marking up.

When the foreman finishes in the place the bolter positions his machine to drill and tightens the maximum number of bolts without shifting machine. He then begins on the left side, drills, inserts, and tightens bolt, then swings crosswise to next location until he has completed the row. After completing this row, he moves the machine forward, changes the safety posts, if necessary, and repeats the above procedure until the place is bolted. Crosscuts are bolted in the same order as entries and rooms. The bolter also installs cable hangers at intersections and boards for attaching ventilation curtains.

Advantages of Roof Bolting

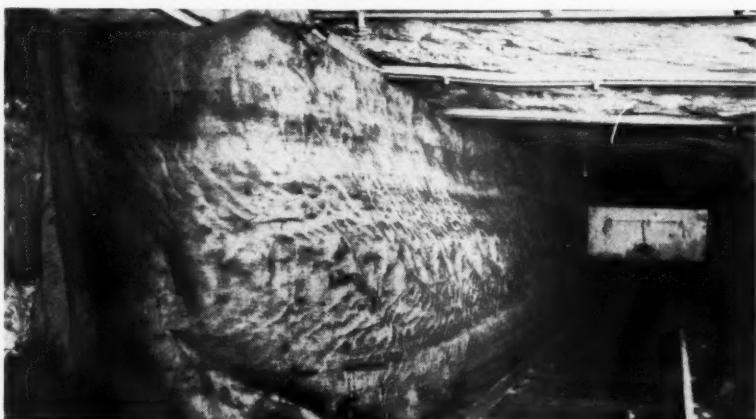
The advantage of roof bolting over conventional timbering from the standpoint of safety in reducing roof fall accidents were soon apparent to us. Other classes of accidents also

favorably affected were those caused from handling bulky timbering supplies and accidents caused by movement of equipment in areas restricted by heavy timbering. The reduction in these classes of accidents by our company has been approximately 80 percent since we started roof bolting six years ago.

The cost of ventilation has been reduced and the quantity of air increased by eliminating most of the timber obstruction in the air ways and the obstruction from roof falls.

Production has been increased by freer and faster movement of equipment into and out of the working faces, less falls to clean up and timber, less material handling by production crews and other less obvious advantages. These factors have been largely responsible for an increase in production efficiency of approximately 70 percent, during the past six years.

In conclusion I would like to give a word of warning. Roof bolting has been a great advance in roof control but it is not by any means the final answer. We must use every effort to improve these methods and greatly reduce roof fall accidents. Much has been done but there still remains a big job ahead of us, which can be accomplished by a lot of work, thought and cooperative effort on the part of every one concerned.



Another convenient use for which roof bolts are adapted is to suspend brattice

**HANDLE
WITH
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Production for a 24-hour period at the Morenci mine averages 170,000 tons. Approximately 53,000 tons is ore and the rest of the material is waste and leach (rock containing copper silicates and carbonates)

Rail Haulage at the Morenci Open Pit Mine

Morenci's rail haulage program posed several individual problems. Here is how the selection of motive power, communications systems, track layout and method of maintenance was made

By W. E. FENZI and L. ORMSBY
General Superintendent Mine Superintendent
Morenci Branch, Phelps Dodge Corp.

THE Morenci open pit copper mine is located in southeastern Arizona, 15 miles from the Arizona-New Mexico state line, and 110 miles north of the Mexican border. The principal copper mineral is chalcocite which is closely associated with pyrite. The chalcocite occurs disseminated in monzonite porphyry, granite porphyry, or as localized veins. The mine encompasses an area of 700 acres in the form of an oval measuring a mile by a mile and one half. There are 23 bench levels which are 50 ft in height with a range

in elevation from 4400 to 5500 ft above sea level.

General Operating Data

The mine is operated on a three-shift basis; the production for a 24-hour period averages 170,000 tons. Of this total 53,000 tons is ore and the rest of the material is waste and leach (rock containing copper silicates and carbonates). The majority of the ore comes from levels below the 5050, although ore has been found as high as

the 5250 elevation. All the ore and leach and almost three quarters of the waste is hauled by rail. The remainder of the waste, some 30,000 tons per day, is transported by truck. Waste rock on the 5300 level and above is handled through the use of rear dump trucks having a capacity of 28 tons. Material below 5300 elevation is moved in trains except for an occasional use of trucks to expedite the establishment of the railroad location.

The rail haulage in the Morenci mine is divided between the disposing of waste from the upper levels to dumps to the north and west, and the transporting of ore and waste to the 4500 level where the primary crusher and mainline waste disposal area are located. The ruling grade on the access switch-backs is 4.0 percent favorable to the loads, but the bottom two benches (4400 and 4450) require advancing loads up a ruling grade of 3.0 percent. The mine contains a total of 68.0 miles of standard gauge track.

The loading and dumping tracks use 90-lb rail and the mainline uses 133-lb rail.

Trains, depending on the locomotive used, are made up of either eight or ten air operated side dump cars. These are 40 or 43-*yd* cars which carry 84 tons of material. They are used for both ore and waste haulage, thus giving the haulage system maximum flexibility. The air brake system on the cars combines straight air operation with automatic air so that a train can be handled with straight air and hold the automatic air in reserve. In addition, the cars are equipped with empty and load brake equipment. The crew for each train consists of an engineer and a brakeman. During the loading operation the brakeman "spots" the cars in front of the shovel. Three train moves, and approximately ten six-*yd* dipper loads are needed to fill a car. Average loading time for a ten-car train is 40 minutes. Dumping of ore into the crusher is accomplished by the train crew and requires about ten minutes per train. Approximately six minutes is used to handle the dumping of the waste trains by the waste dumpman and his helper.

Daily servicing of the locomotives and cars is performed in the upper yard on the 4870 level and the lower yard on the 4500 level. Major repairs are accomplished in the completely equipped locomotive and dump car repair shops which adjoin the upper yard. A schedule of daily and monthly inspections is rigidly followed for all locomotives, with a complete overhaul periodically. As a result, locomotive breakdowns are infrequent.

Rail Haulage Problems

The rail haulage program in the Morenci mine embraces the solution to the problems of motive power selection; signalling and communication; and track layout and maintenance. The purpose of this paper is to discuss briefly each of these factors giv-

ing their background and the developments as they occurred, with particular emphasis on the situation as it exists today.

Motive Power

Three types of locomotives have been used in the Morenci open pit mine since the start of rail haulage in 1940. These are the 1000-hp diesel-electric switcher engine, 1350-hp trolley-electric locomotive with either battery or diesel auxiliary power for off-trolley operation, and the 1750-hp diesel-electric road switcher. Reference is made to the tractive effort vs. mile-per-hour curves for each of the locomotive types which accompanies this report. A brief description of the operating characteristics of each is as follows:

1000-hp Diesel-Electrics: The now familiar 1000-hp diesel-electric switcher was introduced in the later 1930's for yard switching by the Mainline railroads. Through modernization with the passing years, it has maintained a continuing popularity for mainline railroad switching service. This modernization has been engineered so that, through unit exchange of various components, the locomotive has been maintained up-to-date and the power raised to 1200 hp. Its smooth application of full horsepower over a wide range of speeds, and a relatively high horsepower-to-weight ratio makes it particularly adaptable to a mine haulage system. It has excellent truck clearance for mine tracks and a flexible truck which will negotiate a curve in excess of 50°. Very little was known concerning the maintenance expense of these locomotives prior to the purchase of the first four in 1939. Consequently these were sent to the Ajo open pit for trial and study before being transferred to Morenci in 1939 and 1940. These locomotives have had an excellent availability record (in

About the Authors

WARREN E. FENZI obtained a degree in civil engineering from the California Institute of Technology in 1937. Outside of two years spent in the Navy (1944-1946), Fenzi has worked since 1937 for the Morenci Branch of the Phelps Dodge Corp. He has held the position of engineer, assistant mine foreman, mine superintendent, and general superintendent.



WARREN E. FENZI L. ORMSBY

LAWRENCE ORMSBY graduated from Wyoming University in 1928 with a degree in petroleum engineering. From 1939 to 1956, he has worked at the Morenci Branch, Phelps Dodge Corp., as engineer, general mine foreman, and mine superintendent.

excess of 96.0 percent average) and a low repair cost. This locomotive has adequate power to handle a train of eight cars over the track system of the mine. Although slower than the trolley-electrics or the 1750-hp diesel-electrics on the 4.0 percent grades (7 mph vs. 12 mph) it has given a record of excellent service. This situation has been aided by the fact that this locomotive with an eight car train operates primarily on levels above the 5000, hauling waste to the Coronado (north of the pit) and Producer (west of the pit) dumps. The haul from these levels to the upper

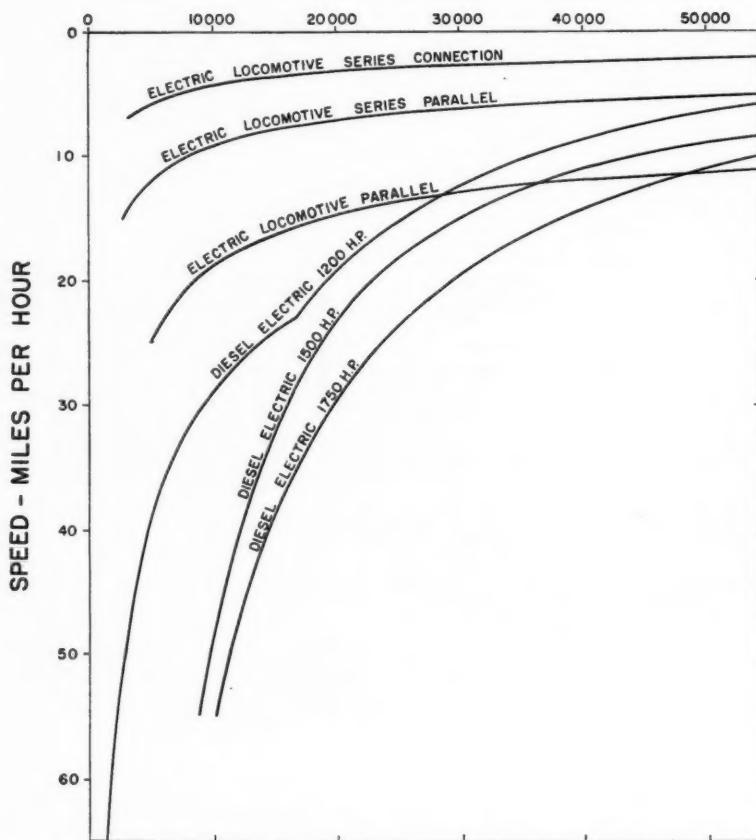


Morenci uses 1750-hp, 125-ton, diesel-electric locomotives for haulage



Track surfacing operation—power tamper and ballast spreader

TRACTIVE EFFORT - POUNDS



Tractive effort vs. mile-per-hour curves for each of the locomotive types discussed in this report

dumps is comparatively short and the grades are essentially level. As a result, three trains can give adequate coverage to two rail shovels. Dynamic braking was not available originally but can now be obtained as a package addition. However, it has not been applied to Morenci locomotives because of the fact that their principal assignments are the level hauls on the upper benches of the mine. There are nine 1000-hp diesel-electric locomotives in service, but three of them are generally assigned to switching and work-train service.

1350-hp Trolley-Electrics: The 1350-hp trolley-electric locomotive, using 750-v d-c power, was specifically designed for service in the Morenci mine. Although most of the components were standard, the addition of 500 ampere-hour batteries to furnish power for off-trolley operation was an innovation. Two conditions at Morenci dictated a decision not to electrify mining benches; one was that the anticipated rate of mining per foot of bench had to be unusually high and the other was that the character of the ground necessitated heavy blasting. The principal application of bat-

tery power was therefore on the bench hauls. A trolley-electric locomotive with a 1350-hp rating was selected to insure sufficient power to operate at a reasonable speed (12 mph) up the 4.0 percent grades with an eight car empty train. This locomotive operated on a constant voltage, which had the effect of reducing power output at low speeds and limiting top speed on level track to 25 mph. This is explained by the fact that to give some flexibility the locomotive was designed to operate in three power ranges: series connection of the traction motors for starting and up to four mph; series parallel connection for intermediate operation (4 to 11 mph); and parallel connection (10 mph to 25 mph) where the full horsepower output was available. This design gave good results within narrow ranges of tractive effort demand and speed, but had the disadvantage of poor operating characteristics where tractive effort demand was high or where relatively high speeds were desirable. The track clearance and flexibility of the truck met the haulage conditions of the Morenci mine trackage very satisfactorily. A dynamic braking system,

which had the capacity to furnish 25 percent of the required braking of an eight car loaded train on a 4.0 percent grade, was incorporated in this locomotive. However, the dynamic braking was only effective up to a speed of 16 mph, at which point it was automatically released to protect the traction motors.

The batteries initially supplied were adequate for level hauls which did not exceed one quarter mile. By 1950 the lengthening of the operating benches made it necessary to replace the batteries with two small (290 hp) diesel-electric auxiliaries per locomotive. In spite of some maintenance problems, the use of auxiliary power as a substitute for trolley power in the loading and dump areas of the mines was justified. Plans for extension of the north side (Medler ramp) access system and for the opening of a new dump site south of the crusher called for trolley electrification of a total of five miles of new mainline track. The high cost of this proposed electrification helped crystallize the decision to replace the 16 trolley-electric locomotives, whose performance under trolley had been entirely satisfactory, with 1750-hp diesel-electrics. This replacement was accomplished in September 1955.

1750-hp Diesel-Electrics: The 1750-hp diesel-electric locomotive is a recent development in which the Morenci mine had the opportunity to experiment with one of the first prototypes. Initially this locomotive was built and used as a 1500-hp road switcher; later, by increasing fuel injection and cooling capacity, the power was raised to 1750 hp on a short time rating. Subsequent modifications have changed this to 1750-hp full time rating. The truck design, which gives a smooth ride over rough track, limits it to negotiation of a maximum curve of 39°. However, this is not too restrictive since coupled dump cars will take only a 42° curve. The smooth application of full power at all speeds gives remarkably rapid acceleration, allowing this locomotive to operate at relatively high speeds for short distances and to take full advantage of any favorable track condition. The locomotive has a well designed dynamic braking system which sustains under load a retarding effect of 2000 hp and maintains it at any speed. The additional provision of automatic sanding and wheel slip control has raised the adhesion factor, so that the handling of ten car trains on the 4.0 percent grades can be accomplished with ease. The present fleet of 1750-hp dieselelectrics consists of 16 locomotives, one of them being assigned as a "pusher" or "helper" for adverse trains up the 3.0 percent grades from the two bottom levels of the mine. Although the first locomotive was purchased in 1952 for use as a "pusher" the complete replacement of the trol-

Types of Loco.	Period	Tons Per Loco. Shift	Length of Haul (Miles)	Availability
1000-HP Diesel Electric	First Six Mo. 1956	2635	2.2	96.0%
1350-HP Trolley Electric	First Six Mo. 1955	2284	3.0	90.0%
1750-HP Diesel Electric	First Six Mo. 1956	2763	3.2	98.0%

ley-electrics was not effected until September 1955 as noted above.

Locomotives Compared

A comparison of the operating efficiencies of the three types of locomotives used at Morenci is of interest. It should be remembered that each type has not operated under exactly the same conditions. However, the above tabulation does offer in part the justification for the replacement of the trolley-electric with 1750-hp diesel-electric locomotives.

Also of interest are the accompanying pie-type diagrams which show the work cycles, in minutes per eight-hour operating shift and in percentages, for two of the three types of locomotive.

Signalling and Communication

Inasmuch as 16 to 18 trains are operated on every shift, traffic control is an extremely important phase of the rail operation. Signalling and communication have progressed through various phases. Initially, signals were manually controlled with a telephone

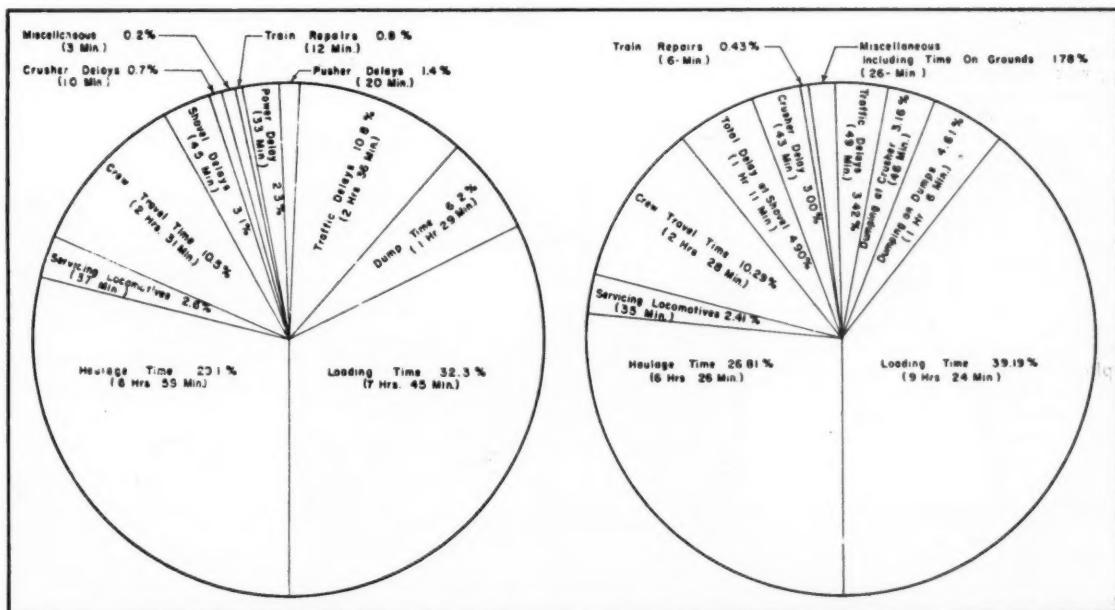
system for communication between points. In 1943 an automatic signal system was installed to handle train movements between the 4750 level and the primary crusher. In 1949 short wave radio was adopted for supervisory control. It also provided direct communication between the chief dispatcher, various points on the railroad, and the locomotives assigned to special duties (the "pusher", the "work train" and the mine "switch" engine). July 1954 saw the installation of the first section of cTC (centralized traffic control) between the edge of the pit and the primary crusher, a distance of approximately one mile. In the years 1955 and 1956 this cTC system was extended to include the northeast access tracks between 4500 and 4800 bench levels, as well as coverage to allow controlled train movements past the primary crusher to the new waste dump tracks to the west. These improvements in signal control and communication have had a marked effect in eliminating delays to train movements. That is especially true during periods when it is necessary to make repairs to the main line and to route trains around the track maintenance work.

Track Layout

The real secret of an efficient rail haulage system is track layout and track maintenance. The ideal mine track system combines minimum curves and grades with maximum access to all areas. Both of these conditions are modified by the terrain conditions which will naturally differ for each mine. It is not usually possible to complete the best track layout early in the mine development because of the tonnages involved. This was particularly true in the case of Morenci, because a number of years of pit expansion was needed before there was room to install access tracks to both sides of the mine. This fact alone has markedly improved the efficiency of train coverage of shovels and has resulted in a 15 percent increase in tons loaded per shovel shift. Unfortunately, haulage track location is never static with a continually expanding open pit. The movement of the Morenci pit to the south requires the relocation of all the southwest switch-backs above 4900 elevation. This new site will be south and east and will include four miles of road bed and track construction. Proper access is so important that savings in shovel loading efficiencies through proper train coverage will underwrite the cost of construction in a short time.

Maintenance Vital

The maintenance of good tracks is so vital that it has been a major point of emphasis. Because a constant increase in labor costs accompanied the



These two pie-type diagrams compare 24-hour operating cycles between the electric locomotive (left) and the 1750-hp diesel-electric (right).

desire to improve track conditions, the only answer was the mechanization of the various operations. The continuing use of large numbers of track laborers with conventional hand tools which coped with the original installation in 1940 could not be tolerated for two reasons: the increase in work load with pit expansion would require such large track crews that from an organizational standpoint it would be inoperable, and the expense would be prohibitive. The lack of manpower during the war years gave the initial impetus to the use of mechanical devices.

The first major change was the adoption of panel track. At present panel track is used on all temporary track in the shovel operating area. Panel track is also used on the dumps and has been used in construction of some permanent tracks, notably the north side access ramp from 4500 to 4800 levels. Panel track answered the basic problem of moving the digging and other temporary tracks.

The proper maintenance of the haulage tracks presented an entirely different situation. The hand labor methods which had been in use during the initial period and through the war years for mainline maintenance had sufficed to maintain rail service, but at a price. In the post war period it was obvious that due to the attrition to the mainline during the previous years a major expenditure of manpower and track material would be required to rebuild and resurface it. The problem of the proper distribution and use of railroad ballast, which is the essential factor in maintaining good track, took a number of years to solve. It was necessary to obtain specially designed ballast cars which would distribute the ballast properly along the track. Next, because smelter slag was the ballast available, it had to be sized and the large pieces eliminated. This was accomplished by screening at the loading dock. Once the ballast could be handled and distributed, the incorporation and use of a power operated jack, a ballast distributor, and a power ballast tamper resulted in excellent roadbed surfacing. As corollaries, other track activities such as laying rails, replacing ties and spiking ties have also been mechanized with various types of specialized equipment. The equipment employed in track work, including flat cars and locomotive cranes for panel laying, represents an investment of many thousands of dollars. The results have been outstanding. The improved track condition has made possible the utilization of the rapid acceleration characteristics of the diesel-electric locomotives and thereby materially decreased the delays to the train movements.

fundamentally the use of mechanical devices has resulted in better track conditions than could have been

achieved using only hand tools and unlimited manpower. Along with the better track some outstanding improvements in the efficient use of labor have been attained. The following

activity. A new level (4350) will be established within a year. Other levels will follow to increase the percentage of production from below the 4500 level. The advertising of material raises

Year	Rail Tons Per Day	Miles of Track	Number of Track Employees	Employees Per Mile
1942	69,140	35.0	290	8.3
1947	103,027	48.5	190	3.9
1956 (Six Mo.)	141,554	68.0	140	2.0

table gives a comparison of the number of non-supervisory maintenance-of-way employees, miles of track, and tonnages handled for three different periods.

The improvement between 1942 and 1947 can be attributed to the adoption of panel tracks, while that between 1947 and 1956 resulted from the mechanization of track maintenance procedures.

Future Haulage Developments

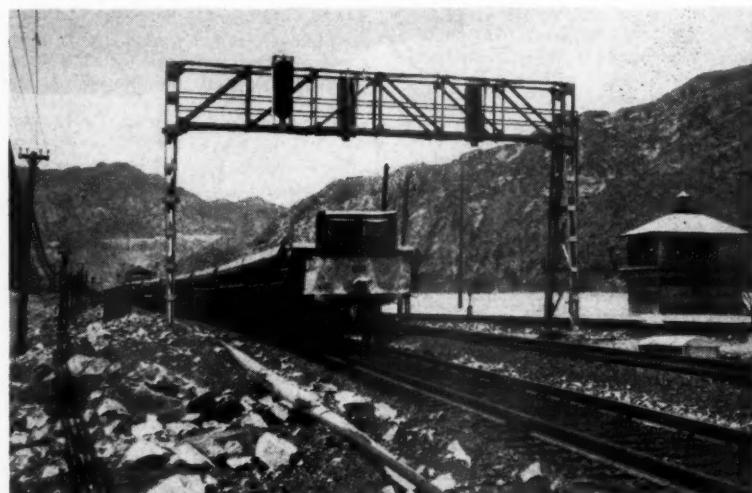
What does the future have in store in the way of rail haulage problems in the Morenci mine? Already mentioned is the major construction project of moving and reestablishing the present southwest access switch-backs in an entirely new area south and east of the mine. This will involve movement of the locomotive yard with its repair shops. The completion of this construction project will improve access, but will not otherwise affect the haulage program except as it will make possible the improvement of the repair facilities incidental to their move.

The advertising of material, principally ore, from the levels below 4500 elevation will be an expanding

two fundamental questions: one, selecting the motive power, and two, solving the track location problem to give the best arrangement within the space available. For the present the use of an extra locomotive as a "pusher" is solving the motive power question but additional thought must be given to that activity.

A new mainline haulage track system is in the process of completion for the purpose of reaching a new waste disposal area 3.5 miles south and west of the primary crusher. The waste dump areas which have been used are nearly filled so it will be necessary to dispose of waste by hauling it a greater distance. At the present time it appears that the 1750 diesel-electric will handle this additional distance efficiently, but undoubtedly future developments in motive power will show improved efficiencies and will therefore have to be considered.

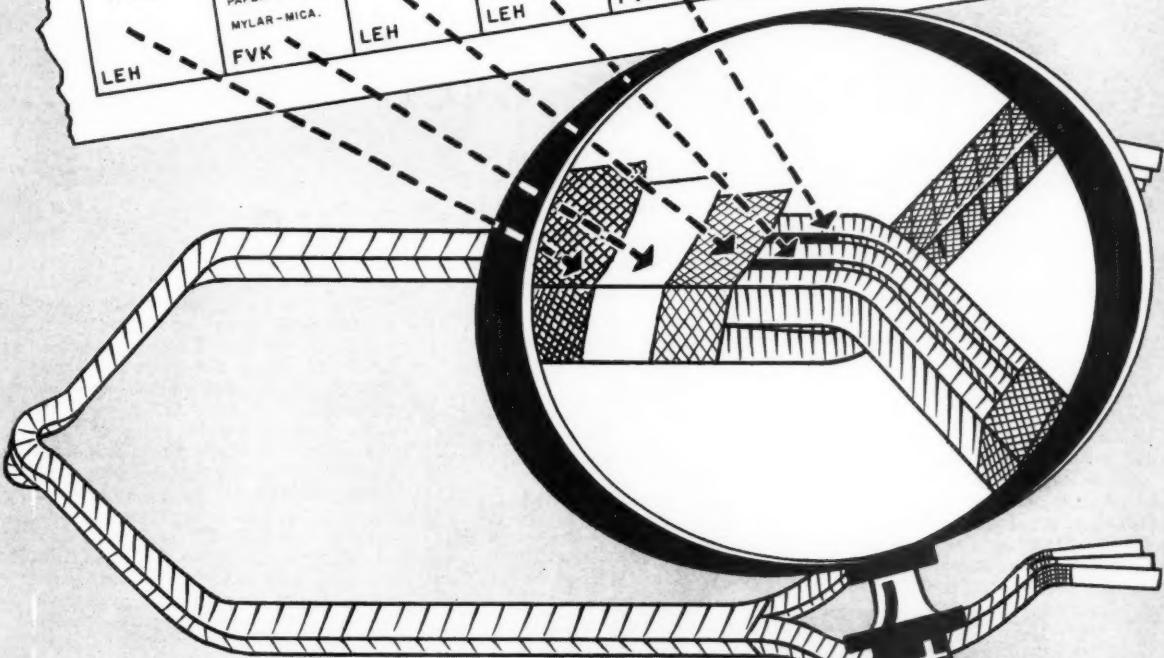
Some worthwhile improvements in rail haulage have been developed during the first 16 years of the Morenci operation. It is a certainty that the future will furnish new ideas in methods and equipment, and the Morenci mine intends to benefit where their adoption will increase haulage efficiencies.



Tower and Signal Bridge—Improvements in signal control and communication have had a marked effect in eliminating delays to train movements

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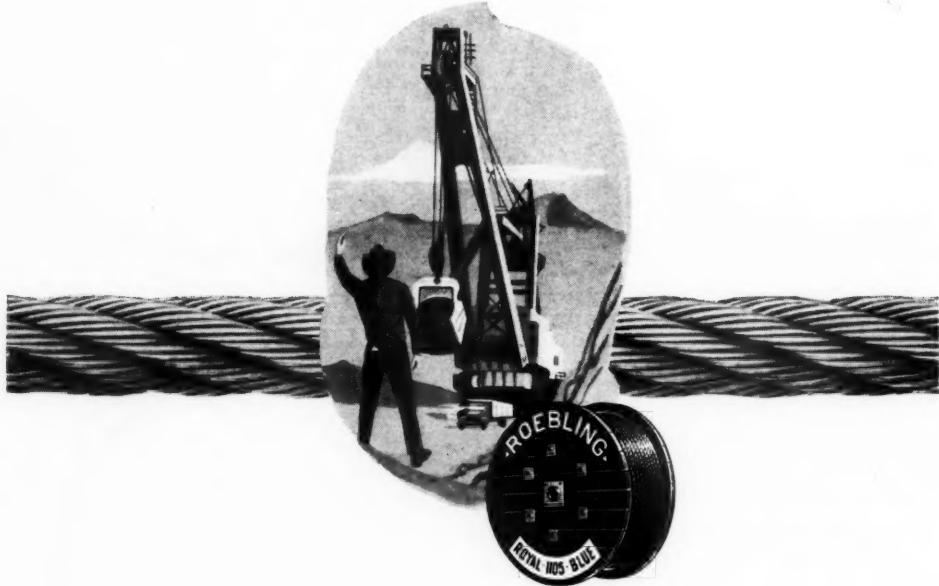
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The latest in mining equipment was displayed

A VERITABLE education in mining was crammed into the first five days of October when some 7500 mining men and women converged on Southern California's metropolis to attend the 1956 Mining Show of the American Mining Congress . . . to view the greatest array of mining tools ever assembled in the West . . . and to express and hear the views of the industry and many of the nation's great leaders on operating and policy problems of mining. The displays of manufacturers' wares in and adjacent to the Shrine Exposition Hall and the sessions in the adjoining theatre were scenes of great interest and activity from the time the hall opened on Monday morning until Thursday evening when the dismantling operations began. Government officials, industry executives, operators and technicians from every mining area in the United States as well as many from Canada, Mexico, South America, Europe, Asia, Africa and Australia were on hand.

A Top-Notch Program

Arranged by industry leaders from all of the various mineral fields in the United States, the Convention program covered all phases of mining, from national mineral policies to the latest in mining methods and equipment. In all there were 23 sessions, of which 10 may be classed as general or economic in nature while the remain-

der were technical—pertaining to specific operations, methods or equipment. The mining industry owes a debt of gratitude to the program committee under the chairmanship of Walter C. Lawson, general manager, Phelps Dodge Corp.; to the state chairmen and members of the Program Committee; to the session chairmen who worked tirelessly on the programs over which they presided, and to the 150 authorities who took part as speakers and co-authors.

Exhibits Excellent

Those who viewed the exhibits know that it would take volumes to set forth the valuable information that convention-goers were able to absorb by inspecting all of the full-sized equipment, operating models, methods demonstrations and graphic illustrations that the manufacturers brought to Los Angeles for the benefit of the industry. With over 90,000 net sq ft of exhibit space occupied, there seemed no limit to the size of the machinery that could be placed on the three floors of the exposition hall plus the large exhibit area outside.

Digging, hauling, drilling and auxiliary units for quarry and open-pit operations; locomotives, loaders, belts, drills, pumps, bits and the dozens of other items required in underground mines; and screens, crushers, classifiers and other important processing equipment were all proudly displayed by the manufacturers who were on hand to discuss and explain for the enlightenment of the observers. Many of the items were unveiled for the first time—thus giving a preview of things-to-come in mining.

The Exposition was put on under the sponsorship of the AMC Manufacturers Division under the chairmanship of Guy V. Woody, General Representative, Sales, Allis-Chalmers Manufacturing Co. It was in all respects the largest, most varied and most complete display of mining equipment ever staged in the West, and a major contribution to operating progress—the results of which will become further evident as time goes on.

Opening Session

Mining men from all parts of the United States and from nineteen for-



L. F. Pett, New Chairman of the Western Division of the American Mining Congress

sign nations received a warm welcome to Los Angeles and to California when the meeting was formally opened Monday morning. With Garner A. Beckett, chairman of the Western Division, presiding, convention delegates heard California's junior Senator, Thomas H. Kuchel, urge them to enjoy their stay in the city and State and wish them Godspeed in their deliberations. He told them that the policies which the industry adopted would be given complete and sympathetic consideration at the next session of Congress.

Kuchel pointed out that the last Congress had produced some concrete evidence of its interest in the domestic mining industry through adoption of the minerals purchase programs and revision of the mining laws. He emphasized the need for Congress to continually work with the executive

branch to see that the intent of laws approved by the legislative body is properly carried out. He also predicted that Congress will act to prevent the Government from gobbling up the public domain of the people through the acts of "bureaucrats with unquenchable thirsts."

Officials of the American Mining Congress, including vice-president Worthen Bradley, Program Chairman Walter C. Lawson, Manufacturers Division Chairman Guy V. Woody, and Coal Division Chairman L. C. Campbell, expressed appreciation for the hearty welcome to Los Angeles and California. They also commended the fine program arranged for the meeting and the splendid array of exhibits, and praised the work of the American Mining Congress on behalf of the entire mining industry. President Howard I. Young was unable to attend the meeting due to illness and a fine tribute was paid him by Garner Beckett, who said that Mr. Young's leadership of the Mining Congress "has been one of the real factors in the growth and effectiveness of the Congress in its service to the mining industry."

Mr. Beckett complimented the many committee members who had worked so hard to develop the program and arrangements for the meeting.

The Opening Ceremonies were concluded with the introduction of distinguished members of Congress, high Government officials, outstanding spokesmen on labor relations matters, and a representative of the Government of Mexico who was on hand to participate in the various activities of the meeting.

Secretaries' Breakfast

Representatives of State and District Mining Associations met at

breakfast Sunday prior to the Convention to discuss problems of mutual interest. Co-chairmen of the meeting were Charles F. Willis, secretary, Arizona Small Mine Operators Association, and George W. Nilsson, secretary, Mining Association of Southern California.

Earl F. Hastings, member of the U. S. Securities and Exchange Commission, briefly addressed the session. He invited the State Associations to submit their views and comments on Federal regulations governing the issuance of stock by smaller companies, and promised that such suggestions would receive careful consideration.

Spokesmen for each of the Associations present spoke briefly on matters of current interest, including pending legislation on both the state and national level, and considerable discussion ensued.

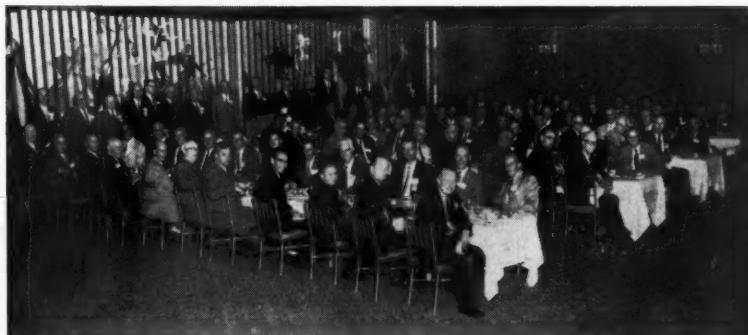
Board of Governors Luncheon

The Board of Governors of the Western Division of the American Mining Congress met at a luncheon on Thursday, October 4. Garner Beckett, chairman of the Western Division, expressed appreciation to the members of the Board and to the various Convention committees and their chairmen who contributed so much to making the Los Angeles meeting such a huge success.

Brief remarks were made by Walter Lawson, chairman of the Program Committee; Guy Woody, chairman of the AMC Manufacturers Division; L. C. Campbell, chairman of the AMC Coal Division; and Kenneth Kellar, chairman of the Resolutions Committee. Kellar reported that the Convention had adopted a resolution commending the Los Angeles Committees,



Miners Jamboree at the Hollywood Palladium



Western Board of Governors luncheon

the press and local groups for their fine cooperation in making the meeting so outstanding.

The Board elected L. F. Pett, general manager of the Utah Copper Division, Kennecott Copper Corp., Salt Lake City, as its chairman for 1957. In this post, he will take an active part in developing plans for the 1957 Metal Mining and Industrial Minerals Convention, which will be held in Salt Lake City, September 9-12.

Members of the Board of Governors of the Division, nominated by the various State mining associations, were also elected.

Julian D. Conover, executive vice-president, American Mining Congress, outlined plans for the Salt Lake City meeting. He reported that the Mining Congress would be unable to go to Denver in 1958, as had been suggested, because additional hotel accommodations would not be available before early in 1959. For this reason, he said, tentative reservations have been made to hold the 1960 Mining Show in Denver.

An invitation to hold the 1958 Con-

vention and Exposition in San Francisco was received and enthusiastically approved. Plans for that meeting are also under way.

Invitations to hold future meetings in Phoenix, Arizona; Seattle, Washington, and Las Vegas, Nevada, were also received and the Board authorized officials of the Mining Congress to negotiate with these cities and report on their findings at the next meeting of the Western Board of Governors.

Policy Resolutions

For months prior to the meeting, mining men representing all phases of the industry gave careful thought to the position which the industry should take with respect to national policies that affect mining. On Saturday preceding the convention the Resolutions Committee, under the chairmanship of Kenneth C. Kellar, of Lead, S. Dak., reviewed and coordinated the drafts from the various subcommittees and prepared an over-all Declaration of Policy, expressing in concise and straightforward language the consid-

ered views of the mining industry. The "planks" of this Declaration were presented at appropriate sessions and received the unqualified endorsement of the Convention.

The Declaration of Policy thus adopted appears on pages ... It has received wide publicity, and following review by the Board of Directors at the Annual Membership Meeting in December, will guide the activities of the American Mining Congress in the coming year.

Special Program for the Ladies

Many of the ladies were on hand at the session halls and about the exhibits; in addition, they had a special program of their own, starting with coffee service during registration. Monday noon a sell-out crowd gathered in the famous Biltmore Bowl for luncheon and superb entertainment by the Hilo Hattie Hawaiian Troupe. A sightseeing tour of Hollywood, Beverly Hills, Bel Air, Will Rogers State Park and the Santa Monica beaches was enjoyed on Tuesday by several hundred of the ladies. The Beverly Hilton was the site picked for the Wednesday Luncheon and Fashion Show, presenting creations by leading California Designers which attracted over a thousand ladies.

Mrs. Harvey S. Mudd was honorary chairman and Mrs. Harold J. Clark, chairman of the Ladies' Hospitality Committee, which did so much to make the ladies welcome to Los Angeles. In addition to the daytime events, the ladies' attendance at the Miners Jamboree and the Annual Banquet on Tuesday and Thursday evenings made these the social highlights of the convention.



Governor Goodwin Knight was toastmaster at the annual banquet



The ladies had a full schedule of luncheons and entertainment

Social Events

From the social standpoint the meeting surpassed all expectations! Even without the scheduled functions it was heartening to witness the cordial greetings which miners extended to old friends and newly met acquaintances at the hotels, the meeting rooms and the exhibition hall. All seemed to be enjoying themselves thoroughly.

A reception and cocktail party on Sunday evening, given by the American Mining Congress in honor of the committee members, speakers and others who contributed their time and effort to making the meeting a success, started off the Convention activities.

Tuesday evening a spirited crowd attended the Miners Jamboree at the Hollywood Palladium. An excellent dinner and dancing to the music of Manny Harmon and his band was followed by a stage program headlined by Dorothy Shay, who sang her favorite hillybilly numbers to the delight of the fun-loving miners. The entertainment also included humorous dialogs between a ventriloquist and his wise-cracking marionette, balancing, juggling and dancing acts and the antics of those three fiddlers, the Wiere Brothers.

Monday and Wednesday nights were open. Wasn't that a shame—all those people in the big city with nothing to do except for the numerous cocktail parties, informal get-togethers and visits to Los Angeles' many famed eating places and night-spots!

The climax came with the big annual banquet on Thursday. It was sold out a month before the Convention, even though it had been expanded to include five dining rooms at the Ambassador in order to accommodate the enthusiastic crowd that didn't want to miss a thing. An enticing menu and danceable music had the groups well primed for the arrival

of Gov. Goodwin Knight, who acted as toastmaster, introducing the dignitaries of the mining industry at the head table in the Embassy Room. Again an outstanding program was arranged, including the popular operatics of Marguerite Piazza, the deadpan humor of "It's Possible!" Johnny O'Brien, and other acts from the world-famous Cocoanut Grove.

Trips

Still going strong on Friday morning some 550 conventioneers, both men and women, boarded busses for the four scheduled field trips.

Loring Marlett, Chairman, and Ronald Griffin, Vice Chairman, did a wonderful job in arranging the trips to take in several of the most important mineral operations as well as other industrial works and some of the famous scenic attractions of Southern California.

The largest group went on the trip

to Disneyland, where they were able to forget their cares by taking a trip to the moon, by moving back a century in time at Frontierland, or by entering the enchanting world of Fantasyland. From all reports the excursion to this renowned play-spot was highly successful.

Earlier risers took in the trips to industrial operations. The Crestmore-Fontana-Irwindale trip gave a large group the chance to see the underground and surface plant activities of the Riverside Cement Co. and to have lunch at the picturesque Mission Inn at Riverside. Following this the group went on to see the Kaiser Steel Plant at Fontana and Rock quarrying and processing by the Consolidated Rock Products Co. at Irwindale.

The longer trip to Boron to inspect the mechanized underground mine, the magnetic separation plant and the newly developed open pit of the Pacific

(Continued on page 104)



Learning, visiting and browsing in the exhibit halls

AMERICAN MINING CONGRESS

A Declaration of Policy

Adopted at Los Angeles, California, October 1-4, 1956

WE commend the present Administration for its persistent efforts to ease international tensions and promote world peace. We of the mining industry recognize only too well, however, that our defenses must be maintained at a level adequate to cope with any eventuality. Production of minerals and metals is essential to the welfare and security of the nation.

The President of the United States has taken a constructive forward step in recognizing the importance of the mining industry by the establishment of Cabinet Committees on Minerals Policy and on Energy Supplies and Resources Policy, to develop national policies relating to the production and utilization of metals, minerals and fuels and the maintenance of an adequate "mobilization base" for the several branches of the mining industry. We commend these Committees for developing recommendations as a basis for sound national mineral and fuel policies. We urge that there be an active program to make such policies effective.

On the domestic front, we likewise commend the present Administration for its continued reaffirmation of the United States philosophy of free enterprise; and for its program of withdrawal of Government from activities which can be adequately financed and more efficiently operated by private endeavor.

We commend the interest taken by the Governors of the Western States in the problems of the mining industry, and offer our continued cooperation in this activity.

While the continuing demand for certain metals and minerals has created conditions beneficial to some segments of the mining industry, many important parts of the industry have not been so fortunate. We again urge that the Government establish a broad policy designed to provide adequate protection to domestic mineral producers.

GOVERNMENT EXPENDITURES

Further determined effort and effective action is needed to limit government expenditures to no more than is necessary to meet defense and

other essential governmental functions adequately and efficiently, honestly and fairly, without waste, extravagance, political favoritism or other unnecessary expenditure. These standards should be insisted upon by all within and without the Government with respect to appropriations, administration and control of expenditures.

We support the principle that Federal governmental activity should not extend to those matters which the people themselves, through private enterprise or their local or State agencies, are able to carry out.

TAXATION

Minerals of the earth made available for the use of mankind are essential for our entire industrial and economic life, for our defense and our welfare. The needs can be met only by finding and developing new reserves to replace those exhausted and to meet additional demands; by research and development of improved processes and methods of production and recovery; by investments of capital and by recurring expenditures for payrolls, purchases and other expenses; and by having the best of human ability efficiently applied to meet the mining and metallurgical problems presented. The risks are great and the failures many. Profits, after taxes, must be adequate to furnish needed incentives if we are to have the continuing supply of required minerals.

Our tax system must be such as to yield needed revenues without discouraging the investment, risk and effort necessary for income-producing activities from which the revenues should flow. We should not by tax rates or substantive provisions impair incentives for economic growth and development under private enterprise and individual initiative which have developed the productivity, prosperity and well-being of our people.

Many desirable improvements have been made by the present Internal Revenue Code, but some of its provisions need revision so they will better express their real intent, eliminate unnecessary

technicalities and have fairer and more appropriate application to the taxation of income.

Taxes should be imposed and administered fairly, equitably and honestly. Our tax system should be well organized and administered to carry efficiently the immense load imposed upon it, preventing fraud, dishonesty and tax evasion, but with fairness to taxpayers, full recognition of their rights and minimum difficulties and disturbance to them in preparation, examination and settlement of their returns.

With respect to income taxation, it is essential that depletion, depreciation and net loss carry-over be full and adequately allowed at not less than authorized by the present Code. We further particularly urge the following:

The present high tax rates leave inadequate incentive for investment, risk, economic effort and initiative. Their reduction will benefit the economy and yield increased revenues to the Government. In no case should the over-all rate on income of the individual or of the corporation exceed 50 percent and in due course should be reduced to not more than 35 percent.

In determining the property basis for depreciation and for cost depletion, the tax benefit rule should be fully applied.

Exploration expenditures should be fully deductible and present limitations should be removed.

The limited allowance now made to stockholders on dividends with respect to taxes paid by the corporation should be further extended. The depletion allowed to a mining corporation should be carried through to the stockholder on an adequate and equitable basis. Intercorporate dividends should not be doubly taxed.

New mines should be exempt from taxation for three years after the beginning of profitable operations.

Capital gains should be taxed at more moderate rates.

United States taxes on income created abroad should give full recognition to its taxability in the foreign jurisdiction and not impose an additional load which may impede or discourage activities abroad. In no event should our taxes be applied to income which is not or cannot be returned to this country. For the benefit of our country and its people and for the peace and well-being of the world, our Government should, by treaty, legislation and otherwise, actively cooperate with any foreign government which wishes to remove barriers to private investment.

LABOR RELATIONS

The fundamental right of every American to earn a living without being compelled to join and pay tribute to a labor union is in grave jeopardy. Long a matter of controversy between union leaders and those who believe in freedom for the individual, the preservation of this right has now become one of the major issues in the basic struggle between those who seek to maintain the principles of freedom and those who would force

us to abandon those principles and take the steps which lead inevitably to labor socialism.

The union leaders have made the destruction of this fundamental right to work the touchstone of their program to control the livelihood of every American wage earner and thereby to dictate the course of our national economy.

To this end they are striving desperately at the State level to eliminate the existing right-to-work laws and to prevent the enactment of such laws in States which do not yet have them. In Congress, their goal is to make compulsory unionism an integral part of the Federal labor laws and to prohibit State legislation in this field.

We believe zealously in the principle of individual freedom. We believe that compulsory unionism is wholly incompatible with that principle.

We therefore dedicate ourselves to the continuation of our long-standing effort to preserve the right to work. We favor the continued recognition by the Federal Government of the right of the States to legislate on the subject of compulsory unionism, and we vigorously oppose the enactment of Federal legislation which would deprive them of that right.

The antitrust laws were designed to prevent monopoly and to promote a healthy economy on the basic principles of the free enterprise system. The fundamental theory which prompted the enactment of those laws is applicable to any form of monopoly which operates directly or indirectly to control production, fix prices or otherwise restrict competition. Present-day big unionism, through the mechanics of merger and compulsion and by the use of such economic sanctions as industry-wide strikes and secondary boycotts, has long since acquired the monopolistic power and control which, for over half a century, have been recognized as constituting a grave threat to our free economy.

The time has long since come when the basic principles of our antitrust laws should be applied by appropriate Federal legislation to the protection of that economy against destruction at the hands of uncurbed labor monopoly.

We urge the immediate enactment of such legislation by the Congress.

The achievement of the economic control sought by the union leaders necessarily calls for political domination. Having at their disposal millions of dollars collected, by compulsion or otherwise, as dues and initiation fees for the purpose of promoting the welfare of union members in the field of collective bargaining, the union leaders

are diverting vast amounts of such union money into political slush funds. Their objective is to place in public office those who will do their bidding and to prevent the election of all those who stand in the way of their grab for power. This they are doing in the face of a Federal law prohibiting the use of union funds for political purposes.

As a result, the right of millions of American workers to exercise individual political action is being thwarted. The earnings of those workers are, in many instances, being used by union leaders to defeat the candidates of the workers' choice.

We urge that the law prohibiting these corrupt political practices be enforced and we again recommend urgently to the Congress that any deficiencies in that law be eliminated.

The fight to maintain and strengthen the basic principles of the Taft-Hartley Act requires constant vigilance and affirmative action. We reaffirm our previously expressed views on the specific measures needed to strengthen that law. Likewise we repledge our opposition to those specific proposals for amending the law which we have previously recited as being aimed at a return to the chaotic days of the Wagner Act.

The forces of labor socialism are moving relentlessly forward. Compulsory unionism, labor monopoly, union political action and a return to government partisanship in the field of labor-management relations are means to an end—the elimination of individual freedom and the destruction of our free economy.

We pledge our continued and vigorous support to a program of constructive legislation in the field of labor relations which will prevent these forces from attaining their objective and which will effectively protect our free enterprise economy against such onslaughts.

SOCIAL SECURITY

We urge upon Congress and the executive branch of our Government a conservative approach towards further broadening of the scope of our Social Security laws. The lowering of the eligibility age for beneficiaries and the broadening of the Act to include disability pensions indicate a trend of political thought which is economically unsound.

It is urged that the taxes collected for the support of social security be placed in a trust fund for the payment of benefits provided for by the Act. We believe the time has come for immediate

consideration of the drastic effect on our economy which will result if this principle is not adopted as the basis for the entire program.

The Social Security amendments enacted into law during the closing hours of the 84th Congress demonstrated with frightening clarity the extent to which political expediency can hasten our embracement of the welfare state. The reduction of the retirement age and the extension of benefits to new areas in an election year, with their obvious political appeal, reflect a highly dangerous trend.

TARIFFS

We again endorse the Government policy that a strong, vigorous and efficient domestic mining industry is essential to the long-term economic development of the United States, and that for an adequate "mobilization base" of metal and mineral production our nation must look to domestic production and ore reserves for the major portion of our metal and mineral supply, despite progressive increase in imports of some of these materials.

Experience has shown that we cannot depend on foreign ore reserves as a source of supply in an emergency, however important it may be to import some metals and minerals to supplement domestic production and to fill our stockpile with materials in which we are deficient. World political conditions, as well as hazards of possible air and submarine warfare, support this conclusion.

We continue to recommend, therefore, that Congress exercise its authority over tariffs, to be administered for the welfare of the American people and provide reasonable tariff protection. In this connection we endorse the recommendation of the United States Tariff Commission to the President on the industry's application for increased duties on lead and zinc. We commend the members of Congress who worked tirelessly in support of the industry. The President's alternative stockpiling program, while having certain desirable features which have been of material temporary benefit, is at best a stopgap solution and does not offer any real long-range cure to the problem of the industry.

A reasonable and workable means of maintaining an adequate "mobilization base" in the production of critical and strategic metals and minerals must be worked out promptly. While each metal or mineral has different problems and each must be considered separately on its own

merits, this mobilization base can be maintained in most minerals and metals by maintenance of a reasonable price. To accomplish this we favor enactment of excise taxes or flexible tariffs on imports, which may be suspended in whole or in part whenever prices are at an economic level that will permit the domestic mining industry to maintain such adequate mobilization base for national security. The use of direct subsidies will lead to eventual government control of industry. The nature of mining requires that the industry make long-range plans, and revocable or stopgap measures by the Government contribute little to the real problem.

We recommend that Congress reject participation in any organization which places the power to regulate trade and foreign commerce of the United States in the hands of any international body.

The industrial strength of our nation has proved itself to be the unfailing mainspring of defense of the United States and the world's free nations. As a keystone to this industrial strength, we strongly urge governmental policies which will assure the maintenance and encouragement of the fullest possible domestic production capacity in strategic and critical metals and minerals.

INTERNATIONAL AND UNITED NATIONS COMMODITY AGREEMENTS

We endorse the action taken by our representative to the United Nations Economic and Social Council, with the concurrence of the President of the United States and the Secretary of State, in opposing the formation within the United Nations of a Food and Raw Materials Reserve. We oppose congressional efforts to reverse this position.

We have consistently opposed intergovernmental efforts to control the price and production of metals and minerals. Accordingly, our 1952 Policy Declaration opposed United States participation in the International Materials Conference. Again, in 1954, we expressed concern over the establishment of a Commission on International Commodity Trade by the United Nations. In 1955 we commended the Administration for its rejection of intergovernmental commodity agreements to control the price and production of basic raw materials. We again commend the forthright position taken by our Government in opposing the adoption of this latest economic panacea which would substitute bureaucratic controls for free markets.

STOCKPILING

We endorse a national policy of stockpiling of strategic and critical materials and the provision of adequate funds at all times for prompt orderly purchases for possible emergency needs. As long as the security of the Free World is threatened, the nation's stockpiles must be filled.

We believe the most efficient and economical procedure is to stockpile at times when output exceeds demand, and that it is in the national interest to reduce or suspend stockpile purchases during periods when shortage of metals causes dislocation of production in defense and essential industries. We also believe that minerals procured for stockpile should be processed to a useable form when capacity is readily available instead of delaying such processing until a time of shortages which may cause serious and unnecessary dislocations.

In connection with minerals and metals in which we normally are not self-sufficient, a definitely stated long-term objective should be fixed and adequate prices paid to domestic producers to encourage the development of domestic reserves and the expansion of domestic production.

No withdrawals from the national stockpile should be authorized except in a declared emergency when national security clearly requires release of a particular material. We commend the Administration and the Congress for the enactment of legislation providing that all metals and minerals acquired pursuant to the provisions of the Agricultural Trade Development and Assistance Act shall be subject to disposition only under the same restrictions as apply to materials in the national stockpile. Metals and minerals acquired under the Defense Production Act should be transferred promptly to the national stockpile.

We oppose the purchase or other acquisition of foreign metals and minerals for stockpile when adequate domestic supplies are available. Although the barter of surplus U. S. perishable products for foreign metals is constructive in its objectives, we oppose the recent action of the Department of Agriculture in holding that metals so bartered must be both mined and refined abroad. If foreign-mined but domestically refined metals are available, we believe that they should be eligible for barter negotiations as well.

LONG RANGE MINERAL PROGRAM

We believe that prompt action should be taken to prepare a long-range program for the development of mineral resources in the United States. Although the responsibility for the preparation of such a program was placed with the Department of the Interior, to date no program has been announced.

We believe continued operation of prospectors and small mining concerns is important because these smaller operations provide a pool of specialized knowledge and trained manpower available for the expansion of minerals production in the event of an emergency. Their activities also are the source of new mine discoveries of consequence.

PUBLIC LAND POLICY

We commend the Department of Agriculture and its Forest Service and the Department of the Interior and its Bureau of Land Management for their policies of inviting and giving consideration to suggestions from the mining industry as to proposed regulations, the application and administration of which may affect the mining industry or some segment thereof.

We oppose the withholding of public domain lands from mining location, either through creation of new withdrawals or maintenance of existing withdrawals, except in cases where the necessity therefor is clearly established. We further oppose the extension or continuation of any such needed withdrawal to any area in excess of that required to serve the particular purpose of the withdrawal. We consider as unwarranted many withdrawals precluding mining development on large areas even though undemonstrated objectives thereof may have been denominated as defense or conservation.

We commend policies which open to mining location lands that had been closed, and urge careful review of contemplated or existing withdrawals to determine the extent to which the creating or maintaining of the withdrawals is actually needed, and also the extent to which lands to be included or retained in withdrawals may be opened to mining location under conditions which will protect the proper objectives of the withdrawal.

We recommend an amendment to the Mineral Leasing Act of 1920 which will eliminate the present limitation as to the maximum acreage

which may be held under a phosphate lease by one person in any one State, thus permitting the presently prescribed aggregate acreage limitation of 10,240 acres to apply without regard to State situs of the holdings.

We recommend an amendment to the General Mining Laws which will afford, prior to discovery, reasonable protection to one who is in good faith engaged in exploratory work.

We reiterate our confidence in the system established by the General Mining Laws for the location and patenting of mining claims as the means of encouraging and providing for development of the mineral resources of the public domain through private initiative and enterprise.

We commend the Department of the Interior and its Bureau of Land Management for its present application of the General Mining Laws in a manner consonant with the spirit and purpose of those laws and with recognition of long-established principles as to what constitutes a sufficient discovery upon a mining claim.

GOLD, SILVER AND MONETARY POLICY

Continuation of restrictions on ownership of gold and failure to take any steps to make more effective use of the nation's stock of monetary gold and silver have made action on the recommendations in our previous statements of policy even more urgently needed.

The few surviving gold mines continue to be faced with diminishing profits as costs expressed in depreciating paper dollars continue to rise while the producers must sell their gold at a price fixed over twenty years ago when the dollar had twice its present purchasing power. The right to own gold is still denied to the American citizen, and the gold miner is allowed no protection whatever against inflation.

Furthermore, with the Treasury acting as a middleman, gold in quantities greater than the entire annual production of the country is supplied to industrial consumers at \$35 per ounce, thus providing them with an unneeded subsidy at the expense of the miners.

Correction of this gross inequity by restoring to the American citizen the right to buy, sell and own gold without restriction, accompanied by termination of the sales of gold by the Treasury to industrial users, would be a simple step, involving no change in monetary policies with regard to gold, that would go far toward relieving the increasingly difficult plight of the gold-mining industry.

The tax on transfers of silver bullion has no place in a free economy and deserves elimination from the statutes.

The place of silver as a monetary metal for appropriate uses is well established, and we commend the policies of the Federal Government that have contributed to this desirable end. Consumption of silver for both industrial and monetary needs is now absorbing available stocks at an accelerated rate. We recommend continued acquisition of domestic silver by the Treasury for monetary needs and urge that the stocks of silver so acquired be held inviolate for such purposes.

In accordance with these views, we recommend that:

- (1) the restrictions on the purchase, ownership and sale of gold and silver by United States citizens be abolished;
- (2) to provide a sound basis for our currency, the Treasury be required to purchase at the monetary price all newly mined domestic gold and silver tendered by producers;
- (3) to preserve and improve the backing of our currency, all present stocks and future acquisitions of gold and silver be utilized by the Treasury for monetary purposes only, and that neither metal be sold by the Treasury for industrial uses;
- (4) Congress fix the ratio at which the dollar and gold are to be made fully convertible and determine other technical procedures involved in the restoration of the gold standard, after receiving the recommendation of a Commission of its creation, to which men skilled in appraisal of the world's potential gold supplies as well as men of competence in domestic and international finance and trade should be appointed by designated Government authorities;
- (5) the Administration recognize the historical and traditional attachment to gold and silver money throughout the world and, as a part of its foreign policy, aid and encourage other governments in restoring gold and silver coinage as a circulating medium, as a standard of value, and as a form of conserving intrinsic wealth.

SOLID FUELS

The nation will continue to grow in industrial might in step with dependable power. There is a growing awareness by Federal and State governments, transportation interests, and the customers of coal, of the well-deserved place which the solid fuel industry has in providing power for the economic life of the United States. The increasing use and dependence upon coal in expanding the power industry is most noteworthy. Only through a sound national solid fuel policy can the nation be assured of adequate productive coal capacity required in these days of new dimensions in almost every phase of general industry. The need of the nation continues for a dependable coal capacity particularly for power, metallurgical

and chemical requirements. It necessitates that this all-important solid fuel industry be maintained and have a growth at an adequate level to assure our national and world markets a sufficient supply of solid fuels in times of peace and war.

URANIUM

During the past year the United States Atomic Energy Commission has sought to meet many of the problems facing the uranium industry. The Commission should be commended for this effort, particularly for its continued encouragement of uranium production and processing, both in the interests of national security and in preparation for increased industrial use.

The Commission by entering into new contracts for expanding milling capacity during the past year has provided better opportunities for the mine operator to dispose of his product. The Commission proposes to authorize the construction of still more mills; we urgently recommend that such contracts not jeopardize the investment in nor duplicate existing facilities. By modifying penalties on high-lime ores, the Commission has aided efficient and economic development of such ores. We commend the Commission for announcing a fixed price for uranium oxide after 1962 which we trust will prove adequate to maintain production at the desired level.

The definition of a mining or operating property in respect to the million-pound per property ceiling under the post-1962 program is ambiguous and should be clarified. The Commission should give consideration to the extension of existing and proposed mill contracts beyond 1962 in order to justify the substantial investment required and to facilitate long-term financing.

We commend the Commission for making available additional technical information relating to concentration and refining processes and for releasing technical and research information to aid in preparing market analyses for future production.

WATER AND AIR POLLUTION

Problems having to do with water and air pollution, in their nature, are uniquely related to individual situations and are therefore local in character. The solution of pollution problems is both the responsibility and the right of local and State jurisdictions. In those cases where local or area pollution problems involve two or more States, the appropriate end should be reached

through the cooperative effort of local, State and Federal authorities to the fullest extent authorized by law, and through the means of interstate compacts.

We commend the Congress, when adopting the Water Pollution Control Act Amendments of 1956, for making provisions for cooperative aid by way of research, and for enforcement with proper respect for local and State jurisdiction in regard to laws, standards and regulations. We believe, however, that the provision for direct Federal aid in treatment-plant construction, through partially lifting local responsibility for financing, will tend to delay rather than encourage needed treatment-plant construction.

We therefore urge the Federal agencies allocating such aid grants to retain full authority for approval of individual grants and to exercise the greatest caution in order that (1) such grants may go only to those areas which are able to demonstrate dire need; and that (2) communities otherwise able to do so will not delay construction in anticipation of sharing the appropriation for such grants.

We urge the Congress in its further consideration of pollution legislation to provide accelerated amortization for pollution control facility installations.

MINE SAFETY

We firmly believe that the providing of safe conditions and a healthy place to work is the primary responsibility of the mining industry. We strongly endorse a positive program, based upon the following policies:

1. That the mining operators participate in regional meetings held periodically where safe working practices, safety education of employees, accident reports and other problems relating to accident prevention are discussed and where ideas of safety men are exchanged.
2. That the mining industry continue to give high priority to the discussion of safety and health of miners in its meetings and continue its efforts to develop positive safety measures for improving the industry's safety record.
3. That the industry continue to promote and expand its medical research programs concerned with health and safety of mining employees.
4. That the industry publications continue to promote a strong safety campaign and show by experience and economic fact the benefits to employees and industry of an aggressive safety program and that mining operators support this campaign by contributing safety ideas and experiences which have proven worthwhile in their operations.
5. That the mining operators stimulate and support greater activity in the field of safety education among employees on and off the job and that management promote and actively support their safety organizations and encourage employee participation.

6. That the Bureau of Mines continue and expand its activities toward developing and disseminating improved techniques in mine accident prevention and promoting mine safety education. Adequate additional funds for the Bureau to carry out this important program should be forthcoming. We firmly believe that any necessary governmental safety regulations should come only from within the governmental structure of the States.

GEOLOGICAL SURVEY—BUREAU OF MINES— BUREAU OF LAND MANAGEMENT

These three Bureaus of the Department of the Interior are most intimately connected with the administration of public lands in their relation to the mining industry.

We wish to compliment the Bureau Chiefs for their continuing efforts to furnish improved service to the public and to make their operations more economical and efficient. These Bureaus furnish many valuable services to the mining industry. Their technical and administrative personnel are outstanding.

We continue our support of adequate appropriations for geologic and topographic mapping.

We urge that continued efforts be made to transfer all Federal responsibilities affecting mineral resources to the Department of the Interior, and deplore the continued policy of scattering such responsibilities among various other departments and agencies.

MINE FINANCING

It is necessary and desirable that mining ventures, whether in the prospecting, development or production stages, be permitted to raise funds for financing. Such financing should be done honestly, without misrepresentation or other abuses. Reasonable requirements to that end are appropriate but they should not be arbitrary nor should they unduly restrict honest efforts to obtain risk capital. We urge that the Securities and Exchange Commission fully recognize these objectives in redrafting its presently proposed Regulations, so that in endeavoring to prevent abuses it shall not prevent proper measures for raising needed capital for mineral ventures.

We recommend that the Small Business Administration liberalize its qualifications for granting loans for worthy mining enterprises. We endorse the Defense Minerals Exploration program and commend the efficient administration thereof; adequate provision should be made for the continuance of this important activity.

RADIO FREQUENCY ALLOCATIONS

A recent survey conducted by the American Mining Congress has emphasized the importance of effective radio communication to the safe and efficient operation of the mining industry.

Many mining operators are now being deprived of the full benefit of reliable radio communication by inadequate frequency allocations. There are over 8,000 stations, most of which are crowded into only 5 channels shared by mining with such unrelated activities as farming, ranching, manufacturing, crop dusting, and appliance servicing. Other industries have frequency allocations of their own, such as 39 for the railroads, 7 for motion pictures, 9 for petroleum and forestry, and 9 for the public utilities.

We again urge the Federal Communications Commission to allocate additional frequencies for use in the mining industry.

GOVERNMENT REORGANIZATION

We strongly urge that continued favorable action be taken to implement the sound recommendations of the Commission on Organization of the Executive Branch of the Government concerning the proper functions and policies of the executive departments and agencies. Only by such considered appraisal and evaluation can the competing and overlapping responsibilities be eliminated and economy and efficiency in the operation of our Government be achieved.

If we are to bring about reduction of the cost of government to those who must support it, it is imperative that the essential functions of government be conducted without waste, extravagance or unnecessary expenditure.

AMC Mining Show

(Continued from page 96)

Coast Borax Division of United States Borax and Chemical Co. attracted many others. Another interesting group went to Richfield's Watson Refinery, the Palos Verdes Peninsula, and the diatomite plant and laboratory of the Great Lakes Carbon Corp., with luncheon at Portuguese Bend Club and a visit to Marineland of the Pacific.

In all, the Convention and Exposition was a decided success to those who took it in as part of an extended trip as well as those who could get away for only a day or so. Many went back to their jobs full of specific ideas for improving their own operations, while all trekked homeward richer in over-all knowledge of mining and with sharpened imaginations that will pay off in the future.

Cooperative Effort

The industry owes a hearty vote of thanks to Garner Beckett, president, Riverside Cement Co., who served as General Chairman of the Convention; to Vice Chairmen William C. Browning and Henry T. Mudd and to Secretary Blair W. Stewart of the General Committee, as well as to the many members of the Los Angeles Committees who helped to assure a full measure of California hospitality to all Convention visitors. Chairmen of Committees, in addition to the Ladies' Hospitality and Trips Committees mentioned above, included Robert Mitchell and George W. Nilsson, Chairman and Vice Chairman of the Welcoming Committee, and Carl P. Miller and Edward D. Arthur, Chair-

man and Vice Chairman of the Publicity Committee.

The smooth running of the entire meeting reflected the efforts of hundreds who lent their support and cooperation to make the 1957 Mining Show a complete success.

Next Year

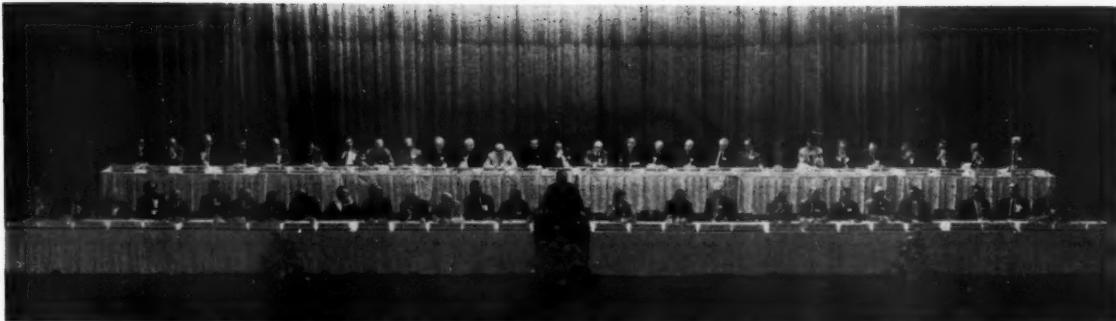
Preparations for next year's convention at Salt Lake City, September 9 to 12, are already under way. The new general chairman is L. F. Pett, General Manager, Utah Copper Division, Kennecott Copper Corp. Vice chairmen are Oscar Glaeser, Vice-President and General Manager of Western Operations, United States

Smelting Refining & Mining Co., and Clark L. Wilson, Vice-President, New Park Mining Co., and Secretary of the General Committee is Miles P. Romney, Secretary, Utah Mining Association. For the Ladies' Hospitality Committee, Mrs. Oscar Friendly has been appointed Honorary Chairman; Mrs. W. G. Rouillard is Chairman and Mrs. M. P. Romney, Vice Chairman.

The industry's progress in the next twelve months will provide the incentive for another series of program sessions, and from the rate at which mining is forging ahead there will be better subjects and more of the answers to present than ever before. You'll want to be there.



A convention field trip gave many the opportunity to inspect the open pit, underground and surface operations of Riverside Cement Co. at Crestmore



Interior Secretary Fred A. Seaton addresses the opening session

A Review of Convention Sessions

- Important Subjects Covered
- Enthusiastic Crowds On Hand
- Discussions Bring Out Answers

THE program of prepared talks on the most significant phases of mining by carefully selected, highly qualified men from industry and government was outstanding—as proved by the capacity audiences which filled the meeting halls. Space limitations permit only a brief outline of each session in this report, to be followed by publication of the full text of many of the papers in future issues of *MINING CONGRESS JOURNAL*.

A LOOK AT OUR NATIONAL MINERALS POLICIES

KENNETH KELLAR, chairman of the AMC Resolutions Committee, presided at this session which followed the opening ceremonies on Monday morning.

Secretary of the Interior Fred A. Seaton declared that improved and extended research and technology, the creation of a more favorable business climate, and a mutually profitable foreign trade policy are the general areas in which the Federal Government can make its greatest contribution to the strength and vigor of our minerals-producing industry. He reported that the President has directed—and that he himself has promised—that the Department of the Interior will submit to the Congress at its next session a Government outline of a long-range minerals program which



Industry leaders from all the various metal fields took part in the program

will encourage the full and orderly development of the Nation's mineral resources.

Seaton called upon the mining industry to embark on a program of exploration for new mineral deposits. "The Administration," he assured, "will make every effort to encourage this movement and to create a favorable environment for industry to make large investments of risk capital in the vital search for mineral wealth."

Rep. Clair Engle, Chairman of the House Interior and Insular Affairs Committee, said that if we are to have a National Minerals Policy, there must be substantial agreement among three

groups—the industry itself, the Executive agencies and the legislative branch of Government. He declared that the basic problem of the mining industry is that we cannot meet or cope with foreign competition. In discussing the three possible solutions to the problem—tariffs, quotas or subsidies—Engle said that tariffs are a "sacred political cow" and that a National Minerals Policy based upon increased tariffs is absolutely hopeless and out of the question. He spoke more encouragingly of quotas, but said that direct production assistance is the most difficult program to enact.

LABOR RELATIONS

THE Monday afternoon session on Labor Relations was presided over by Clyde E. Weed, president, The Anaconda Co.

Senator Barry Goldwater of Arizona, in discussing labor relations and States' rights, said that the right to work without compulsory unionism is a right that must be protected if the rights of life, liberty, and the pursuit of happiness are to be preserved. "The threat of an ever-expanding Federal Government is a far more serious threat than Communism," he declared. "If the trend toward centralized Government is continued—and if the people of this country do not wake up—we will soon be 'brainwashed' by the postulants of socialism."

Former New Jersey Congressman Fred A. Hartley, Jr., co-author of the Taft-Hartley Act, characterized today's union leaders as " betrayers of the philosophies of the organizers of the labor movement."

"The merger of the AFL and the CIO," he said, "was not a merger of labor, it was a merger of union leaders for political purposes. The rank-and-file has still to be merged." Hartley said that the Taft-Hartley Act should be amended to contain a definition of peaceful picketing, and should limit pickets to employees of the struck firm.

Dr. Leo Wolman, National Bureau of Economic Research, Inc., declared that unions have become the most dangerous type of monopoly and are exercising powers and privileges that are rightly the function of the Government. He said that the anti-trust laws should govern the activities of unions as well as those of private industry. Wolman cited many union activities as unlawful, such as obstructing highways and violence employed during picketing activities, and called upon State and municipal authorities to prevent such actions by use of their police authority.

TAXATION

ON Wednesday afternoon a panel discussion on mineral taxation, under the leadership of AMC Tax Committee Chairman H. B. Fernald, highlighted many of the tax problems facing the industry as well as recommendations for improvements in our tax laws.

Senator Thomas E. Martin of Iowa, in a statement read to the convention by S. H. Willison, vice president, Cordero Mining Company, declared "I think it is fair to say that over the past several years Congress has not had an entirely deaf ear to the tax problems of this important industry. However, many improvements are still

needed in our tax laws as they affect the mining industry." Martin pointed out that "these are days of cold wars and ever-present threats to our way of life; a time when we need to encourage large-scale exploration for and development of our nation's mineral wealth; a time when we must do all we can to build a mining industry capable of providing the required raw materials for an adequate mobilization base and an ever-expanding industrial economy." He said that our tax laws have a direct bearing on how well the mining industry can meet our present and future mineral requirements.

Senator Clinton P. Anderson of New Mexico told the audience that "mining is a risky business, as I know from personal experience, and it is my belief that this must be recognized in our tax laws. It is an industry that cannot be maintained on a stop-and-go basis. Our tax laws must be such as will permit the miner to weather the storm during lean years." He said that production of minerals creates new wealth and thus new sources of revenues and that it "makes sense

through the concessions that may be given if the tax rate is high that the economy can be controlled the most easily."

Referring to the tax treatment afforded the minerals industry, Curtis declared "The extractive industries lay claim to a differential tax treatment on a very firm basis. Unlike other kinds of businesses, their capital is not readily replaceable. As long as our tax laws are going to recognize depreciation allowances for replacement of machinery and equipment necessary to conduct a going concern, we are going to have to set up a differential for those businesses which cannot, by their very nature, be certain of replacing their capital goods that permit them to remain a going concern."

Chairman Fernald stated that taxation has become one of our major burdens and problems; yet "we recognize that taxes are necessary for maintenance of Government. Without them we could not have the benefits of safety, law and order, the productivity and the opportunities we enjoy." He warned, however, that zeal for reve-



A distinguished panel at the Labor Relations session

then that we write tax laws that will encourage mineral production."

To help remove the tax roadblocks that kill off the incentives to search for and develop new mineral wealth, Anderson called for (1) adequate depletion allowances, (2) removal of the limitations and deductibility of exploration expenditures, (3) tax exemption for new mines for a period of three years, (4) an over-all reduction in tax rates, and (5) taxation of capital gains at more moderate rates.

Anderson declared that "you have many friends in Congress who will continue to point out ways in which our tax laws can be improved in the interest of building and sustaining a strong domestic mining industry. We welcome suggestions from you miners on how this can best be done."

Congressman Thomas B. Curtis of Missouri, member of the tax-writing Ways and Means Committee, told the gathering "those who believe that our economy must be planned and controlled through Government fiat are intent upon keeping high tax rates and high Federal expenditures, regardless of the purpose, so that the high tax rate may be justified. It is

nuances should not lead to taxation which leaves inadequate incentives for investment, effort and risk to give the employment we want, the production we desire and the creation of incomes from which the revenues may flow. He said that we do not gain if taxes are such as to defeat the revenues at their source.

Referring to the Revenue Code of 1954 and recent studies on improving it, Fernald stated "I believe Congress is endeavoring to give us an equitable law under which business and the people can prosper. I also believe the Treasury is endeavoring better and more fairly to administer the law. This I think we should recognize although we still have the right and the duty to present our criticisms, recommendations and suggestions as we see occasion therefor."

Ellsworth C. Alvord, AMC Tax Counsel, summarized the afternoon's tax talks and discussed our nation's present economic status and the outlook for the future. He predicted that the national income will increase again next year and that the Government probably will operate in the black in 1957.

GOLD, SILVER AND MONETARY POLICIES

CO-CHAIRMEN Donald H. McLaughlin, president, Homestake Mining Co., and Robert M. Hardy, Jr., president, Sunshine Mining Co., presided over the session on Gold, Silver and Monetary Policies.

B. F. Pitman, Jr., president, Pitman & Co., Investment Bankers, said that our present gold policies endanger our national security and democratic institutions. He reported that, at the end of 1955, foreigners held an estimated \$17 billion in short-term dollar claims against our gold reserves of approximately \$21.8 billion.

Without a monetary system tied to a gold standard, Pitman declared, inflation will very probably continue. The downward spiral in the value of the dollar, he said, has already discouraged savings and correspondingly encouraged borrowings. Pitman predicted that the day will come when the Government will frantically implore a sorely crippled gold industry to step-up production.

Senator Wallace F. Bennett of Utah said that there is the prospect of another conflict during the next session of Congress over the desirability of our present Silver Purchase Act. He called upon the silver producers to maintain their vigilance in dealing with this expected problem.

Elgin Groseclose, economic counsel, Washington, D. C., suggested that the most constructive thing that can be done under the Foreign Aid Program is to encourage and assist the governments of underdeveloped regions to reestablish the coinage of silver in their countries at its intrinsic value. "I believe that with the restoration of silver money freely circulating in those countries in which it has been traditional," he declared, "and the rehabilitation of gold at its proper value in the currencies of West, we have the foundations of universal prosperity and stability, and a program upon which all men concerned for these purposes can agree."

PUBLIC LAND PROBLEMS

REP. WILLIAM A. DAWSON of Utah, who presided at the session, said the American people owe a debt of gratitude to members of the mining industry for their constructive attitude in obtaining solutions to conflicts between public and private use of the Federal domain. "I am confident that the passage of Public Law 167 by the 84th Congress has prevented passage of more stringent legislation that would have blocked all future mineral developments in large areas of the public domain," he said.

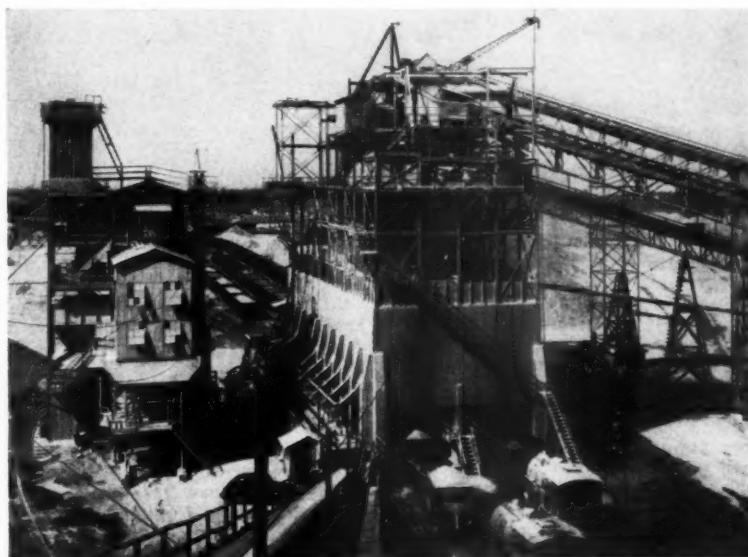
Wesley A. D'Ewart, Special Assistant to the Secretary of Agriculture, said that Public Law 167 was described by President Eisenhower as "one of the most important conservation measures affecting public lands that has been enacted in many years." D'Ewart then reviewed the provisions of Public Law 167 and reported that contests in determining surface rights under the law will be much fewer than originally expected. "I am sure that it is the intention of the Department of Agriculture to give widespread publicity and information to the mining industry in order that there will be no misunderstandings or misconceptions as to the rights or privileges of mining claimants under Public Law 167," D'Ewart said. "I trust that by making this information available, and by personal contact such as we have seen at this meeting of the mining industry, the excellent relationships previously built up can be maintained and improved."

Edward P. Cliff, Assistant Chief, U. S. Forest Service, explained his agency's administration of Public Law 167. He said that the law has not been on the books long enough for the Forest Service to evaluate fully the

Secretary of the Interior. Other panel members included Robert S. Palmer, executive vice-president, Colorado Mining Association; Clair M. Senior, Senior & Senior; Richard N. Hunt, vice-president, U. S. Smelting Refining & Mining Co.; Roger H. McConnell, chief geologist, The Bunker Hill Co.; and C. J. Parkinson, The Anaconda Company.

MANAGEMENT PROBLEMS

CHAIRMAN CLARK L. WILSON, vice-president, New Park Mining Co., in introducing Morrough P. O'Brien, chairman, Dept. of Engineering, University of California, to talk on "Mining's Shortage of Engineering and Scientific Manpower—What to do About It?" questioned the validity of the subject. O'Brien indicated that in some spots there was no shortage, but over all the problem definitely is acute. The children of depression families with a low birth rate are now being educated and that is one reason for lack of engineering candidates. He indicated that the company interviewers are making students pay-conscious,



The Irwindale plant of Consolidated Rock Products Co. was visited by Los Angeles conventioners

problems that will develop, and he expressed the opinion that it is going to require a little give and take on the part of both the miner and the forest ranger and a good understanding of each's responsibilities and rights to avoid local differences. He called for a continuation of the teamwork approach that is so well on its way at the present time.

Need of legislation to permit broader use of new exploration techniques was discussed by a panel of experts headed by Elmer F. Bennett, Assistant to the

when really the student wants to know more about his future opportunities for advancement with the company. Obtaining engineering employees is a big problem, he said; their retention is also a problem. Mining companies should encourage and recognize professional abilities to help meet this problem. He suggested that we must start training students in mathematics in the tenth grade, and certainly must work for more and better teachers.

In a discussion of "Nonproductive Wage Costs and Their Significance,"

L. J. Randall, president, Hecla Mining Co., observed that employees generally talk of their base pay but entirely forget the fringe benefits which may be as high as 25 per cent of their base pay. He detailed some of these fringe costs and quoted figures from the U. S. Chamber of Commerce, which has contributed extensive studies to this problem.

Howard B. Gundersen, assistant director of industrial relations, Kennecott Copper Corp., in speaking on the subject of "Education of Employees in the Economic Principles of Mining," raised the question "Why Should Industry Educate its Employees?" He then emphasized that students are graduated with scant understanding of practical economics, and it takes education following school to eliminate this problem. He indicated that busi-

fellow workers. He pointed out that one of the problems of arriving at mining incentives is the non-uniform work cycle which tends toward guess-work in setting up standards.

"Supervisory Incentive Plans in the Mining Industry" was the subject of a paper by Morley H. Mathewson, manager, Industrial Engineering Department, International Minerals & Chemical Corp., in which he discussed the philosophy of management as being important in setting up incentives and the need for sound industrial engineering as the approach for evaluation of such a program. He indicated that they had had considerable success at International Minerals & Chemical Corp. by correlating productivity with cost and quality.

In the ensuing discussion a question was asked from the floor as to the



Practical considerations of supervision were discussed at the Management Problems session

ness must, and is now beginning to, recognize the human element in each employee. Business must also recognize the trend to collectivism. Based on these two points, industry has a big job in orienting its thinking and its treatment of employees.

Talking on mining incentives in the Coeur D'Alene District, John Edgar, manager, Mining Div., Sunshine Mining Co., mentioned that there are two groups of incentive payments: fringe benefits as discussed by Mr. Randall and production bonuses. He mentioned that the production bonus was actually developed during the war as a stimulus for keeping employees and increasing production and that this system is really a hang-over from that time. The production bonus, of course, increases speed and does make control of work simpler. He included in his paper an analysis of the Coeur D'Alene District contract systems, and offered ten or twelve rules for using incentive plans.

Theodore Barry, president, Theodore Barry & Associates, in his paper "Incentive and Motivation," indicated that good mining means that employees are fully utilizing their abilities. There are two important areas of motivation—money and social motivation—which include an employee's feeling for his company, supervisor, and

practicability of share-the-profit plans for employees. Mathewson and Barry answered the questions, indicating that their attitudes toward profit-sharing were rather negative.

STATE OF THE METAL MINING INDUSTRIES

WALTER C. LAWSON, general manager, Phelps Dodge Corp., Douglas, Ariz., presided over the session on the State of the Metal Mining Industries.

In discussing the outlook for non-ferrous metals, Simon D. Strauss, vice-president, American Smelting & Refining Co., said that although the nonferrous metal miners as a group are making larger profits this year than they did last, the maintenance of this happy state of events in the future is by no means assured. Actual production, he pointed out, is currently in excess of demand for the three major metals and the continuation of present prices depends either on an improvement in demand or on Government intervention in one form or another. "If the excess continues and there is no stockpiling," Strauss said, "some mines somewhere will have to close down or curtail."

Walter A. Sterling, president, Cleveland-Cliffs Iron Co., said that the year 1956 could probably have been the top year in iron ore history had it not been for the steel strike and a strike of the licensed officers on a large part of the Great Lakes ore fleet.

Foreign imports of ore, he said, have increased from 11,000,000 tons in 1953 to a probable 31,000,000 in 1956 and imports will, no doubt, increase next year.

He reviewed the present aggressive world-wide search for iron ore and the intensive research to find economic means to use low-grade taconite and jaspers.

Although adequate tonnages of iron ore will be available in the next few years, he stated, certain trends in the steel industry indicate there may exist a scarcity in some types of iron ore and for ore suitably located with regard to centers of use.

Charles Boyle, Aluminum Corp. of America, presented a paper on light metals which had been prepared by Lawrence Litchfield, Jr., vice-president of Alcoa's Mining Division.

Boyle revealed that both the aluminum and magnesium industries are highly optimistic that the upward trend of consumption will continue. He said that U. S. domestic aluminum-smelting capacity will increase during 1956 and that further expansion is expected during the next two years. The aluminum industry is turning to coal-fired steam power in much of its new smelting capacity, he pointed out, because freight rates have risen faster than power costs. Reserves of bauxite in the Western Hemisphere appear to be ample to supply North American requirements for aluminum for many years in the future, Boyle stated.

He also said that additional magnesium production capacity will be needed to keep pace with the steadily increasing demand.

In reviewing the position of the strategic metals, S. H. Williston, vice-president, Cordero Mining Co., outlined the situation existing in mercury, columbium-tantalum, tungsten, manganese, antimony, asbestos, chrome, rare earths, cobalt, and titanium, asserting that the problems of all of these strategic metals are similar. "Those which have still continuing Government purchase contracts can look a few years into the future with reasonable assurance," Williston declared. "Those with only short-term purchase orders or none at all face a considerably more uncertain future."

Merritt K. Ruddock, Almar Exploration Co., San Francisco, reviewed the history of uranium production on the Colorado Plateau, pointing out that the domestic industry started from scratch in 1948 and in 1956, moved the United States into first place among free nations in the production of uranium ores. He ex-

pressed the hope that the AEC will use the utmost care to insure that existing uranium mills will have access to a reasonable share of ore reserves when present contracts are completed and ore purchasing becomes competitive.

Ruddock said that in the growth of the uranium industry, "the AEC and in particular such thoughtful and far seeing man as Jesse Johnson, who has ably headed the Division of Raw Materials Procurement, have contributed much."

The diverse and unusual properties of several of the rare metals were described by Eugene B. Hotchkiss, vice-president, Vitro Corp. of America. The transition of once-rare metals such as aluminum, magnesium, and titanium from relative obscurity to economic importance was described by Hotchkiss, who said that in each case a costly, arduous, and long research program had to be successfully completed before the metal became an article of commerce. He said there is no short cut to a bonanza in the field of rare metals, but that there is a challenge to those who will develop the immense wealth of rare metal resources in this country.

STRATEGIC MINERALS CONFERENCE

THE Conference on Strategic Minerals was presided over by S. H. Williston, vice-president, Cordero Mining Co., and chairman of the Strategic Minerals Committee of the American Mining Congress.

Senator Alan Bible of Nevada, in referring to the assurance given by Interior Secretary Seaton that a long-range minerals policy would be submitted to Congress in the next session, said, "I trust it will be aimed toward making this Nation adequate, in peace and in war, to meet all requirements of its industrial growth. Such a program must be intelligent in design, administratively workable, aiming toward the protection of the American standard of living, and of sufficient permanency to bring stability to our great and proud mining industry." He declared that we must stop curing our ills by legislative shots-in-the-arm for first one ailing segment and then another.

Bible pointed to the Suez Canal crisis as an example of an unforeseen international development that could place the United States in a vulnerable position because of our dependence upon overseas supplies of strategic and vital minerals.

Rep. William A. Dawson of Utah said that it has always seemed foolish to him for the Government to encourage the dispersal of vital defense industries while at the same time continuing policies that discourage the location, development and production

of raw materials which these industries must have. "If the production of that vital defense factory is dependent upon the output of some mine in French Morocco," Dawson declared, "the dispersal program is meaningless. The factory might just as well be built in Casa Blanca under those circumstances. More and more people within the administration are recognizing the paradox and I am hopeful that this recognition will bring about a critical re-examination of policies that discourage new mining developments."

Dawson said that he intends to reintroduce legislation in the next session of Congress which would require that findings of the Tariff Commission in escape-clause proceedings be referred to Congress, rather than to the President, for final action.

URANIUM IN THE FUTURE

THE Thursday afternoon session under the chairmanship of P. L. Merritt, senior geologist, E. J. Longyear Co., was devoted to the outlook and future significance of uranium.

Senator Clinton P. Anderson (Dem., N. M.), Chairman of the Joint Committee on Atomic Energy, gave an up-to-date appraisal to the past year's developments in uranium discoveries, applications, markets, and legislation concerning atomic energy. He spoke about the transition from military markets to the civilian power market, referring to the extension of the domestic uranium purchasing program from March 31, 1962, through December 31, 1966. Anderson reiterated his



SENATOR CLINTON P. ANDERSON, Chairman of the Joint Committee on Atomic Energy, presents his observations on Uranium

A panel discussion on the Outlook for Strategic Minerals was then conducted by Williston. Those on the panel included Charles H. Segerstrom, Jr., president, Nevada-Massachusetts Co.—tungsten; F. A. McGonigle, vice-president, Haile Mines, Inc.—manganese; Hollis Dole, chief, Oregon Department of Geology and Mineral Industries—chrome; Gordon I. Gould, Gordon I. Gould & Co.—mercury; James P. Bradley, vice-president, Bradley Mining Co.—antimony; E. B. Douglas, manager, Calera Mining Co.—cobalt; Richard Quirk, assistant manager, Mining Department, National Lead Co.—titanium; Robert B. Porter, president, Porter Brothers Corp.—columbium-tantalum; R. I. C. Manning, director, Arizona Department of Mineral Research— asbestos; Harold Bailey, manager, Mountain Pass Mine, Molybdenum Corp. of America—rare earths; R. H. Thielemann, director of metallurgy, Stanford Research Institute—metals research; John G. Liebert, assistant to the assistant secretary of Interior for Mineral Resources; E. H. Weaver, commissioner, Defense Materials Service, General Services Administration; and Spencer S. Shannon, director, Office of Mineral Mobilization.

judgment of a year ago when he spoke of the possibilities of hydrogen reactors and advised that this achievement appears so remote that it does not constitute a threat to the future growth of the uranium industry. He quoted an AEC report which said, "Such a reactor is purely of academic interest for the foreseeable future."

On the subject of developing a civilian power market, which is of vital importance to the uranium miner, he said that the Joint Committee on Atomic Energy had found that the reactor program is lagging badly. He said he hoped that a bill which would have provided \$400 million in Federal funds for an accelerated civilian power reactor program, which failed to pass last year, would be reconsidered in the next Congress.

The technological advances of the past year and the military applications programs were discussed by Anderson to the extent that security permits. Nuclear-powered surface vessels for both the Navy and the Merchant Marine are in the planning stage, and he expressed his belief that "the future of nuclear propulsion systems is very bright indeed."

A proponent of the "Atomic Bank," Anderson said he believed that it is up

to the Government to prevent a sag in the uranium market if the military requirements fall off before civilian power programs get started, because the development of atomic power is in the national interest. Anderson concluded that "it is the obligation of the Government to achieve a long-range and consistent program" and expressed the hope "that we may go forward together."

Richard E. Barrett, manager, Ore Procurement Division, Eldorado Mining & Refining, Ltd., of Canada, spoke on the Canadian program in atomic energy. He reviewed the purchasing policies in his country and the overall production and occurrence of the important Canadian deposits. Barrett went on to describe each district in detail, pointing out the mining and concentrating methods being used. He then told of the various research projects undertaken in Canada for the development of civilian uranium markets and recounted the progress in Canada's five major nuclear reactor programs.

"The Future of Uranium in the Atomic Industry" was presented by Dr. Chauncey Starr, vice-president, North American Aviation, Inc. He reviewed the pattern of energy consump-

energy. Herzog observed that it is desirable for his company to start its uranium work early, and to get into it at the present time when, because of Government guarantees, there is a reasonable expectation of a modest profit. Furthermore the petroleum industry finds itself exceptionally well prepared for uranium exploration by virtue of its similarity with exploration for oil. Herzog concluded that it was natural for the petroleum industry to look to uranium as the complement of oil in maintaining the energy supplies of the world.

INDUSTRIAL MINERALS

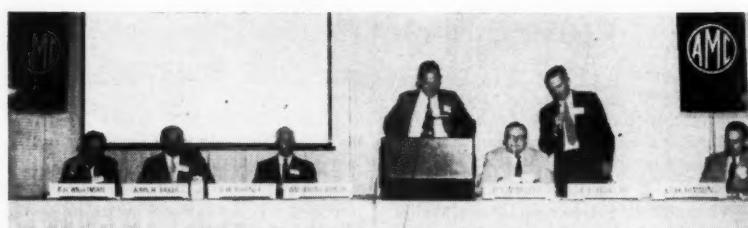
"DEVELOPMENTS in Industrial Minerals" was the subject of a session on Tuesday morning at which Co-chairmen D. L. Marlett, Vice-President, Great Lakes Carbon Corp., and W. W. Mein, Jr., President, Calaveras Cement Co., presided. In calling the meeting to order, Marlett explained that industrial minerals were being emphasized at this meeting in recognition of their growing importance in our mining industry and our industrial economy.

of calcium and magnesium silicate designed for appropriate end uses. He listed the three phases of the operation as (1) raw material preparation, (2) the reaction step, and (3) filtration, drying and packaging. Flowsheet, plant photos, electron micrographs and a generalized process description were included together with properties and fields of use of the finished products.

"What Makes a Gypsum Deposit Economic?" was the subject of a paper by J. F. Havard, vice-president, Fibreboard Paper Products Corp., in which he said that a large part of the nearly 15,000,000 tons of gypsum rock consumed in the United States went into the manufacture of nearly 8 billion sq ft of board products. Most of it was quarried or mined by major companies, but independent rock producers in some locations successfully sold retarder to portland cement plants and soil conditioner to agriculture. Havard recounted the chief factors in making a gypsum deposit economic as being (1) available markets, (2) low mining costs, (3) cheap transportation to point of use, (4) good competitive quality and (5) adequate tonnage. He said that the most serious defects of gypsum deposits are interstratified impurities, anhydrite, structural problems and subsurface solution.

Oliver E. Bowen, Jr., associate mining geologist, California State Division of Mines, spoke on "Recent Developments in Limestones, Dolomites and Cement in California," pointing out the immense value of California's numerous limestone and dolomite deposits to the manufacturing industries. Bowen stated that the items in top demand in California are new and better deposits of pure white limestone and dolomite for chemicals and fillers; iron-free limestone and dolomite for glass; non-decrepitating limestone of high purity for sugar refining; and colored carbonate rocks for terrazzo chips and roofing granules. He reviewed the new large deposits at which operations had started during the past year. Several outside interests, he said, had been contemplating erection of plants in California in recent years, but the only new operators to enter the field did so by buying out companies already established there. Bowen cited the present trend toward integration of operations in the cement industry in which mineral production, material manufacture and concrete fabrication are all performed by the same company. He enumerated some of the projected public works projects for California, concluding that it is "easy to see why the construction industry and manufacturers that supply it are confident of future demand."

The last paper of the afternoon, by Paul W. Leppla, Technical Director, Great Lakes Carbon Corp., was on the subject of "Perlite and Other Lightweight Aggregates." He traced the growth of this youthful industry from



Operating phases of industrial minerals production received lots of attention

tion over the past 100 years, and looked forward 100 years or so to the exhaustion of the conventional fossil fuels. Pointing out that it will be 10 years before reliable nuclear power plants are demonstrated and that it will take up to another 50 years before they assume a dominating role in power generation, he stated that "it is not too early now for the initiation of nuclear power."

The economics of power from nuclear energy was analyzed and compared with present power costs, and Starr indicated that nuclear power will in time become competitive, but he concluded that "one can only speculate on the nature of a society without fossil fuels available at reasonable cost."

The final paper of the afternoon was presented by Gerhard Herzog, Director of Research, The Texas Co., under the title "A Petroleum Company Looks at Uranium." Dr. Herzog pointed out that the business of his industry is in effect the sale of B.T.U.'s and therefore it is most natural that it should be interested in any new source of

The first speaker was Richard F. Brooks, manager of mining operations, Gladding, McBean & Co., who presented a paper on "Significant Developments in Ceramic Raw Materials and Markets." He described the exploration and development programs of the two companies that produce and consume red-burning fire clays. Some of the uses for ceramic materials cited by the speaker were the glass industry in northern California, the manufacture of ceramic veneer, and all types of refractory products. Brooks recounted the treatment processes and the equipment used in refining clays and pointed out the value of converting what was considered relatively valueless material into high grade products.

Herbert L. King, Jr., research manager, Celite Dept., Johns-Manville Corp., in his paper "Diatomite in Calcium and Magnesium Silicates," described a hydrothermal process whereby diatomaceous silica from the Johns-Manville deposit near Lopoc, Calif., is converted to several physically and chemically different forms

its shaky start in the early 1940's to its present annual volume of over \$12,000,000. Leppa reviewed the major sources of crushed and sized perlite ore which included the plants of the Great Lakes Carbon Corp. at Socorro, N. Mex., and Florence, Colo.; the F. E. Schundler Co. plant at Antonito, Colo.; the Combined Metals Co. plant at Pioche, Nev., and The U. S. Gypsum Co. plants at Grants, N. Mex., and Lovelock, Nev. Most of the perlite deposits, he said, consist of more or less massive volcanic flows and are operated as open pits by rippers and scrapers or power shovels with very little blasting. In analyzing perlite markets Leppa said that about 70 percent of U. S. production is used in plaster, 20 percent in concrete and the remaining 10 percent for various other purposes.

* * *

A second session on "Industrial Minerals," this one devoted to production and processing, was held Wednesday afternoon. Wm. Wallace Mein, Jr., president, Calaveras Cement Co., and D. L. Marlett, vice-president, Great Lakes Carbon Corp., who as members of the Program Committee organized and engaged the speakers for both industrial minerals sessions, served again as co-chairmen.

"Heat Processing of Pelletized Materials as Developed for the Cement Industry" was the title of the first paper, presented by B. H. Puerner, assistant manager, Processing Machinery Department, Allis-Chalmers Manufacturing Co. He pointed out that heat processing in the cement industry is accomplished on a mass production basis with rotary kilns and separately with traveling grates such as sintering machines, but went on to say the rotary kiln by itself does not attain the thermal efficiency of the grate, and the grate by itself does not attain the uniformity of product possible with the rotary kiln. By combining the two, he said, several advantages are demonstrated such as: lower dust loss, lower fuel consumption, and more uniform product. Puerner said further that fuel savings with a double pass grate and rotary kiln system average 40 percent better than conventional rotary kiln operation in the cement industry, and that with certain variations, the double pass grate and kiln system can apply to processing of other minerals such as iron ore, phosphate, magnesite and conversion of fly-ash to lightweight aggregate with significant advantages in fuel saving and uniformity of product.

F. E. Legg, Jr., assistant professor, construction materials, University of Michigan, and assistant supervisor, Michigan State Highway Dept. Laboratory, followed with a paper on "Heavy Media Separation Process for the Production of Specification Gravel for the Manufacture of Concrete." Legg said that users have long recog-

nized the surface defacement evidenced by pop-outs and spalls and the internal distress of concrete caused by certain rock types occurring in coarse aggregate. Investigations by the State Highway Laboratory at the University of Michigan over a wide range of glacial deposits in the Michigan area showed that these deleterious particles were predominantly of low specific gravity and thus removable by heavy media processes. Five commercial plants ranging in capacity from 100 to 300 tph have been established in Michigan at pits heretofore considered incapable of providing premium quality gravel. These pits are now producing acceptable aggregates which otherwise would have to be imported from some distance away.

Next on the program was John H. Baker, assistant to manager of production, American Gilsonite Co., who discussed "Recent Developments in Mining and Transporting Gilsonite." After touching on the history and geology of Gilsonite, Baker described the recently developed method of mining Gilsonite hydraulically. The technique of handling it in preparation to pumping from the mining area over a mountain pass to the refinery 200 miles away was also described, as were the mechanics involved in handling Gilsonite with water.

Fred L. Hartley, vice-president, and G. H. Hemmen, chief engineer, Union Oil Co. of California, combined their talents to prepare a paper entitled "Union Oil Company Shale Demonstration Plant, Mining and Retorting Methods." Hemmen presented the paper and said that Union Oil Company is studying methods for producing commercial products from shale oil and is conducting experiments with retorting oil shale to find the answer to just one question, can they produce merchantable shale oil at a cost low enough to make it competitive with petroleum? He went on to describe the open pit mine operated by Union Oil Company for the recovery of oil shale and the method of retorting to recover raw shale oil.

R. H. Wightman, superintendent of mining, Riverside Cement Company, Crestmore Division, concluded the afternoon session with a paper, "New Underground Mining at Crestmore." Wightman said that surface mining of limestone began at Riverside in 1909.

In 1927 an underground block caving system of mining was started; and in 1941 electric shovels and diesel trucks were used to produce quarried limestone in conjunction with the underground mine. The underground mine was shut down in 1954 and a new mine adjacent to the old one opened up shortly thereafter. He went on to describe in detail the new underground mine at Crestmore, commenting particularly upon the haulage system which uses electrified diesel trucks.

EXPLORATION AND GEOLOGY

TUESDAY'S Exploration and Geology session was presided over by James Boyd, vice-president, exploration, Kennecott Copper Corporation, and Ira B. Joralemon, consulting engineer. In opening the meeting, James Boyd pointed out that the first crop of mineral deposits now being mined were found from their surface expression. To discover the next crop a sophistication in the use of modern technology will be required. Exploration will be costly and beyond the means of most individuals, but with use of modern techniques and the help of the government agencies, industry can expect to be replacing our reserves at a sufficient rate to supply the required materials.

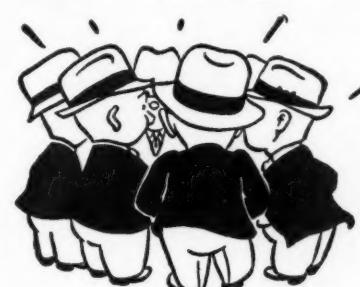
Joralemon, describing briefly the use of modern techniques, pointed out that the past few years have been one of the most active periods in the United States exploration in which no fewer than 35 important mines have been discovered and brought to production.

D. A. Lockheed, assistant general manager, Falconbridge Nickel Mines, Ltd., of Canada, described the activities of his company in discovering some 11 new ore bodies in the Sudbury area, two brought from traditional discoveries of outcropping ore bodies and the rest by the use of modern techniques of geology and geophysics. His remarks illustrated successful use of such techniques.

Blair Stewart, vice-president, Coronado Copper and Zinc Co., outlined the modern organization for exploration and some of the difficulties experienced by the modern exploration company in carrying out its activities.

Dr. Thomas B. Nolan, appearing for the first time before the American Mining Congress since his elevation to the directorship of the United States Geological Survey, described in considerable detail the services and programs of the survey in its aid to the exploration activities of private industry in the United States.

Mr. Paul Allsman, chief mining engineer of the United States Bureau of Mines, described the availability of some 15,000 mine examination reports available in the Bureau files, most of



which are available to public scrutiny and which might save a great deal of time preventing the examination of prospects which have been examined often by individuals in the past. He described the availability of diamond drill cores in the Bureau's core libraries.

The formal papers were followed by a number of pertinent questions asked of the panel by the audience which filled the room and numbered between 250 and 300 people.

UNDERGROUND DRILLING

A DRILLING Symposium was arranged by the AMC Underground Drilling Committee for a Tuesday afternoon session with O. A. Rockwell, vice-president, Eagle-Picher Co., presiding.

"Standardization of Measurement in Underground Drilling" was discussed at length by Raymond M. Stewart, assistant planning engineer, Climax Molybdenum Co., in a paper that demonstrated that value of standardization as accomplished at Climax. The value to the industry of adopting standard performance data, along with a free exchange of test data, was forcefully presented.

L. F. Bishop, research engineer, The Anaconda Co., commented on Stewart's paper and proposed a standard classification of ground.

S. S. Clarke, consulting engineer of Baxter Springs, Kans., further discussed the subject, relating test work and standard data to actual on-the-job performance. He pointed out the difficulty that managements will have if proper allowance is not made for the wide variation in working conditions

between test work and production. The miner's "skill factor" was cited as highly significant in drilling performance.

C. N. Kravig, mine superintendent, Homestake Mining Co., in a paper presented by William C. Campbell, assistant mine superintendent at Homestake, dealt with the maintenance of drills and drill rods. The facilities and practices in use at Homestake were described in detail, showing what records were kept on drilling equipment and the action taken as a result of these records.

M. L. McCombs, application engineer, Joy Manufacturing Co., in discussing Kravig's paper, analyzed some of the reasons for excessive maintenance costs and offered practical measures for correcting them. He pointed out that less than half of drill maintenance expense is brought about by normal parts failures, while some 60 percent is due to lack of lubrication or to dust in the drill.

T. E. Giggy, sales representative, Ingersoll-Rand Co., commented on maintenance of tungsten carbide bits. He stressed the need for supervisory control to eliminate pilfering, to train miners in the proper use of bits, and to keep accurate records for comparative figures in over-all mining costs. The importance of proper shop equipment, gauges, and procedures was emphasized.

George H. Hazen, plant superintendent, Brunner & Lay Co., further discussed maintenance, stating that great strides have been made in the development of new and better machines and improved bits, but that drill steel is being used exactly as it was in past years. He stated that more footage at less cost to everyone would result from more careful use of steel and bits and more control in the workshop.

UNDERGROUND MINING

JOHN D. BRADLEY, president, The Bunker Hill Co., presided at a session on "Underground Mining" Wednesday morning. First speaker of the morning was R. W. Edwards, superintendent, Inland Steel Co., who spoke on "Support of Heavy Ground in Bulk Mining Operations." Edwards said that in the Lake Superior district the use of timber for support is decreasing, although where timber is used, treated timber is gaining favor. Roof bolting is increasing in use in areas where slate is encountered and where spalling ground is a problem. Roof bolts, however, are not used where ground flow or subsidence is present. He went on to say that concrete has been unsuccessfully used for ground flow and subsidence and that rigid steel sets are better than wood for transfer work but fail under the extreme pressures of bulk mining. In conclusion Edwards said that the use of yielding steel arch sets is rapidly spreading and, as more and more operators gain experience with them, and as their crews learn to install and maintain them properly, the sets are the best solution yet devised for the problem of controlling heavy grounds.

This paper was discussed by J. W. Still, consulting engineer, who pointed out that no two caving operations are exactly alike nor are weight conditions in any one mine the same all over. He discussed the many factors that complicate both the occurrence of weight and subsequent handling of it in outlining the experience of Miami Copper Co. in mining 55,000,000 tons of ore. He illustrated the adverse effects of these factors on costs, grade and extractions resulting from weight.



An attentive crowd listens to the Underground Drilling Symposium

"Underground Uranium Mining Methods" was the subject of a paper by Donald T. Delicate, superintendent of mines, and Gordon M. Miner, assistant superintendent of mines, Utah Division, Homestake Mining Co. In it they reviewed some of the mining methods used and being developed in underground uranium mines of the Colorado Plateau. He pointed out that the mining methods selected for underground uranium mines depends on several factors which vary with each ore body—such as size, continuity, grade, and shape of the ore bodies to be mined. Open stoping methods are widely used in smaller mines with good back conditions and irregular ore bodies. Room and pillar mining with large trackless equipment is frequently used in the larger mines, although little pillar extraction has been attempted to date. A method of retreat mining in which successive panels are extracted is being used at one mine with induced caving of the block after each panel is removed. Other systems such as the long wall method utilizing steel yielding props to provide support and maintain a cave line are being considered.

A symposium on underground transportation completed the morning session, three speakers presenting individual reports.

Charles A. Cleeves, assistant mine superintendent, Climax Molybdenum Co., spoke on "Rail Haulage at Climax." Cleeves reported that 11 Atlas 19-ton four-wheel locomotives and seven GE 20-ton swivel-truck eight-wheel locomotives hauling 20 to 24 Grandby type ore car trains on two main haulage levels had handled a production averaging 31,130 tpd in 1956. Cleeves said that large crusher and large bin capacities are necessary to eliminate delay in dumping. Train movement is regulated by an inside dispatcher who has control of all main intersections. Three methods of communication are used; a bell telephone system, a mine telephone system, and radio telephones on all trains. The accident record has continued to improve, both in frequency and severity, during the last 2½ years under this type of haulage system, while haulage costs were reduced by four percent from 1954 to 1955. This is attributed to larger tonnages being hauled in 1955.

"Conveyor Haulage at Carlsbad," was the topic of the paper by J. E. Tong, assistant manager and mine superintendent, Duval Sulphur & Potash Co. Tong said that conditions unfavorable to rail haulage led his company to experiment with belt conveyor haulage. To do this it was necessary to crush the potash before transporting by belt. Use of a high-capacity single roll crusher and belt speeds to match the rate of discharge from shuttle cars has made belt haulage practical, while carefully engi-

neered installations, rigid inspection routines and preventive maintenance have made it economical.

Gill Montgomery, vice-president and general manager, Flourspar Division of Minerva Oil Co., concluded the symposium with a paper on "Auto Trucks Underground." Montgomery spoke highly of the use of auto trucks, with diesel engines equipped with fume scrubbers, particularly in the case of bedded-type deposit ore bodies best adapted to rubber-tired haulage. The full text of his paper appears in this issue of *MINING CONGRESS JOURNAL* starting on page 42.

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Another operating session on "Underground Mining" was held Thursday afternoon with A. S. Kromer, vice-president and general manager, Calumet Division, Calumet & Hecla, Inc., as chairman.

Elmer A. Jones, manager, St. Joseph Lead Co., presented the first paper which was entitled "Mechanization at Indian Creek Mine of St. Joseph Lead Co." Jones described changes in mining and haulage equipment that have taken place in the Indian Creek Mine since it was started late in 1953. Loading machine changes have been slight and the original objection of high maintenance cost has been overcome by better design, preventive maintenance and closer supervision and study. Haulage has posed a changing problem because of the increasing length of haul as mining progressed away from the shaft, and the company changed from shuttle car haulage to the use of six-ton diesel trucks. Jones concluded by saying that lower haulage costs have been obtained by investing in better roads, road maintenance equipment, and modern underground shop and tool facilities. At the present time the production of 2000 tons per day is being maintained by four loading units and eight haulage units operating two shifts per day.

"Shaft Sinking in Uranium Mines on the Plateau," was the topic of a paper by William H. Love, manager of mines, and Philip Lindstrom, superintendent, Utah Operations, Hecla Mining Co. Lindstrom presented the paper. "Shafts are becoming more important on the Colorado Plateau because the search for uranium ore has been progressing back from the walls of the canyons and deep drilling is revealing new ore bodies," Lindstrom said. He outlined the shaft sinking problems that many uranium mine operators face and detailed briefly the method used at 15 individual properties on the Plateau to put down shafts.

E. Dana Cory, chief electrical engineer, The Cleveland-Cliffs Iron Co., presented a paper entitled "Koepe Hoist Installations at Cliffs Shaft Mine." Cory described the first installation of a multiple Koepe hoist

in the North American continent which is now in successful operation at the "C" shaft of the Cliffs shaft mine of the Cleveland-Cliffs Iron Co. He used photographs and charts to describe this particular installation and also discussed the movement of ore through an underground crushing plant and the shaft to the shipping point.

"Incline and Vertical Shaft Sinking with the Cryderman Machine," was a topic of a paper by J. C. O'Donnell, development engineer, Shaft & Development Machines Co. The Cryderman machine is a patented Canadian shaft mucker now being used in Canada and which was recently introduced into the United States as an innovation in shaft mucking. The machine is actuated by seven air cylinders and works equally well in incline or vertical shafts. Mucking is performed by an air-powered grab bucket mounted on the end of telescopic boom. One operator uses only two levers to control all movements.

T. E. Howard, U. S. Bureau of Mines, and F. E. Burnet, Montana Phosphate Products Co., collaborated on a paper entitled, "Planing Phosphate Rock in Western Montana: An Experiment in Continuous Mining in Inclined Phosphate Beds." Howard presented the paper. He described the Bureau of Mines experimental phosphate planer, patterned after a German coal mining device, which has been in operation near Garrison, Mont. Among the advantages claimed for the planer are increased labor productivity, improved recovery, and safer working conditions. During one of the test periods time study showed an average production of 13 and a maximum of 30 tons per man hour. In comparison, average mine production with the regular stoping method is 30 tons per man shift. Howard concluded by saying "the full potential of inclined planer mining has yet to be determined, but the possibilities for greatly reduced costs with this type of mechanization are so good that it should be investigated for mining many of the softer ores which occur in bedded or tabular deposits."

OPEN PIT MINING

"OPEN Pit Mining," occupied the attention of convention goers Tuesday afternoon in a session chairmaned by A. D. Chisholm, managing partner, Pickands Mather & Co.

"During the past ten years, there have been many indications that a more economical drilling method was required on the Mesabi Range," said the first speaker, R. W. Whitney, general manager of mines, The M. A. Hanna Co. Whitney went on to say that experiments with various models and types of drills indicate that rotary drilling on the Mesabi Iron Range

is here to stay. He further stated that with the use of rotary drills, he believed that cost reduction will come about through (1) increased drilling rate, (2) reduction in drilling and maintenance labor, (3) reduction or elimination of auxiliary pit services, (4) reduction or elimination of drill sharpening facilities and costs, and (5) more uniform blast hole sizes. He concluded by saying a great deal of research and testing has to be done to develop bits of longer life and greater penetration rates, and that improvements should be made to the drilling rig to facilitate moving and maintenance.

Martin J. Hughes, mine manager, Kaiser Steel Corp., followed with a paper on "Blast Hole Drilling at the Eagle Mountain Mine." Both churn and rotary drills are used at Eagle Mountain in the production of 10,000 tons of iron ore and 20,000 tons of waste daily. Hughes described and compared the four types of machines which have been used in primary drilling and showed penetration rate, bit life and direct drilling cost per foot. He concluded by saying the savings in drilling costs justifies the choice of rotary drills for current drilling requirements.

There followed four papers on the general subject, Transportation from Open Pits. The first of these was presented by Lloyd S. Campbell, assistant general superintendent, Eastern District, Oliver Iron Division, U. S. Steel Corp., who described "Belts and Belt Conveyors as Used in the Transportation of Ores from Open Pit Mines." After briefly touching upon the history of conveyor haulage in iron ore mining, Campbell went on to describe the many considerations to be taken into account in deciding whether or not conveyor haulage should be used in an open pit. He told of engineering advances and new developments in belt construction and conveyor haulage and concluded that belt conveyors will find more application in open pit mining.

C. V. Isbell, Isbell Construction Co., followed with a paper on, "The Various Types of Trucks for Open Pit Haulage." Isbell described the various truck classes designed and built for off-highway use and told where each had its primary application. Unfortunately, Isbell continued, he had never found the "ideal" situation where the pit could be engineered and designed to competitively use just one type and size of haulage equipment. By far the most common situation is that the original pit plan will require one type of truck for pioneering and the early hauling, and several other types to complete the development of the pit in the most economical manner. He said that the type of haulage used in any pit will be determined by conditions and that the solutions to many

haulage problems will be a combination of transportation systems.

A paper on "Rail Haulage at Morenci," was co-authored by Warren E. Fenzi, general superintendent, and Lawrence Ormsby, mine superintendent, Phelps Dodge Corp. In presenting the paper Ormsby opened with a short description of the Morenci open pit and then turned to three rail haulage problems and how they were solved at Morenci. The three problems were: selection of proper motive power, signalling and communication, and track layout and maintenance. All of these problems were defined as they relate to Morenci and the system worked out to overcome them was described at length. Ormsby concluded with a look at probable future developments which will change both the problems and their solutions at Morenci.

"Skip Haulage" was the topic of the final paper of the afternoon and was presented by Richard P. Cardew, engineer, National Iron Co. Cardew compared the four major material hauling systems used in open pit operations, pointing out operating advantages and disadvantages of each. He said that skip haulage systems are designed on the Iron Range to follow the natural angle of repose of the pit wall which can vary from 25 to 45°. He gave cost figures comparing various types of haulage systems which were furnished by two mining companies.

* * *

C. D. Michaelson, general manager, Western Mining Divisions, Kennecott Copper Corp., presided over the Thursday morning session on Open Pit Mining. It featured a diversity of mining projects in several climates and in several minerals fields.

Walter L. Rice, president, Reynolds Mining Corp., described the bauxite mining operations of his company. He showed how a flexible system of mine operations, with multiple sources of supply, is provided to assure a constant flow of ore to the company's reduction plants which require continuous 24-hour operation every day of the year. Mining techniques have been developed to make all-weather operations possible and to provide each operation the capability of doubling or tripling production on short notice. Transportation facilities have similarly been geared to this pattern of flexibility.

Edward P. Shea, geologist with The Anaconda Company, told his capacity audience about the planning that went into Anaconda's new open pit mining project in the Butte District. He described the drilling program carried out from surface with churn drills, sinking holes 200 ft apart, and establishing an ore body in excess of 100 million tons. A preliminary pit was excavated by a contractor and metallurgical research

tests on the ore milled verified the churn drill estimates and proved the ore body to be satisfactory. Anaconda will proceed with a full scale open pit mining operation.

Willis H. Wamsley, mine superintendent, Pacific Coast Borax Div., spoke on the new developments in California borax mining. He described the change from underground to open pit mining and the construction of new concentrating and refining plant at Boron which was necessary to obtain better recovery and satisfy increased demand. Ore mining and waste stripping are accomplished with up-to-date methods and the latest in earth-moving equipment.

D. R. Purvis, superintendent, American Smelting & Refining Co., presented a paper on ore production from the recently developed Silver Bell Pit. He covered pre-production waste tonnage, production ore tonnage and grade, construction of a four-mile haulage road, new mill construction, new town construction, and plans for converting the pit from contract to company operation. All development and production proceeded according to predetermined plans.

MILLING AND METALLURGY

THE first operating session on Monday afternoon was devoted to several of the most important phases of milling and metallurgy. Chairman of the session was Roy A. Hardy, consulting engineer, Getchell Mine, Inc.

Fred C. Bond, consulting engineer, Allis-Chalmers Manufacturing Co., gave the results of a detailed study of the basic economics of wet vs dry grinding. The advantages and limitations as each method were discussed in detail with particular attention being paid to costs of installation, maintenance, as well as the over-all grinding cost. It was pointed out that the nature of the product desired, or some other extraneous circumstance, rather than the comparative efficiencies of the two methods of grinding, usually determines which is selected.

"Experience With Cyclones at Chino" was the subject of a paper by Paul A. Lemke, metallurgical engineer, Chino Mines Div., Kennecott Copper Corp. It revealed the practical use of cyclones for thickening copper concentrates, or in fine grinding circuits, classifying middling concentrate for regrinding, de-sanding milk of lime, and classifying and thickening of tailings at disposal areas. Dimensions and operating data on Chino's installations were presented in detail.

"High Voltage and Magnetic Separation," described by J. Hall Carpenter, partner, Carpcos Research &

Engineering Co., is the basis for new methods which have become important tools in the ore dressing field. These methods have been applied successfully to beach sands for recovery of titanium, zirconium and associated minerals for some time, and are now finding use in the production of many other minerals produced in different forms from various locations. The techniques of high voltage and magnetic separation methods were described and a summary of applications throughout the world was presented to broaden the listener's understanding of the subject.

"Emulsion Flotation," a highly enlightening explanation by A. W. Fahrenwald, dean emeritus, School of Mines, University of Idaho, was presented by Royce A. Hardy, general manager, Manganese, Inc. Emulsion flotation was described as a process employing reagents, soap and oil in emulsion form, in amount many times that required for froth flotation. Its application to the manganese ores of Manganese, Inc., was described and shown to be remarkably successful.

* * *

Another session on Milling and Metallurgy was presented on Wednesday morning under the chairmanship of F. A. McGonigle, vice-president, Haile Mines, Inc.

The first paper of the afternoon, "New Conveying and Electronic Weighing System," was very well presented with appropriate slides by Melvin A. Stokke, superintendent, East Anaconda Crushing Plant, The Anaconda Co., at Anaconda, Mont. As Mr. Stokke unfolded his story about the details of the new system of a modern tipple, crushers and conveyors, the slides corroborated his description of the successful handling of around 700 cars of copper, zinc and manganese ores. A short discussion followed.

Robert J. Linney, vice-president, Operations, Reserve Mining Co., Silver Bay, Minn., was unable to attend the convention to give his paper on Taconite Beneficiation. In his place, Mr. A. S. Henderson, chief process engineer for Reserve Mining Co., showed a color film entitled "Operations at the E. W. Davis Works." The film was narrated by Mr. E. W. Davis and gave an excellent graphic story of this successful new venture from the pit operation through ore processing to delivery of taconite pellets at the docks to the ore boats or stockpile. There were a few questions asked from the audience and the comments congratulated the Reserve Mining Co. for their achievement. Linney's original paper appears as an article on other pages of this issue.

"Practical Aspects of Pressure Leaching and Precipitation Processes" was the next subject on the program, when once again Professor Frank A. Forward, Head, Department of Mining & Metallurgy, University of Brit-

ish Columbia, Canada, gave the audience the benefit of his many years of experience on certain phases of the chemical treatment of ores. The problems involved in this process are manifold but gratifying progress is being made in the treatment of a few refractory ores.

Co-authors R. S. Olsen and M. F. McCarty, metallurgists, Mining & Metallurgical Technical Service & Development, Dow Chemical Co., in their paper on the "Applications of Solvent Extraction in the Metallurgical Industry," came up with a theoretical and well worthwhile paper on the winning of metals from solution. Sharp attention was given to Mr. Olson as he presented the story very well amplified by slides. If and when this type of process is practical, the predicted economic treatment of marginal and/or refractory ores will be achieved.

A lively discussion of all papers followed the closing of the session.

HEALTH AND SAFETY

ON Thursday afternoon a "Health and Safety Conference" was held under the chairmanship of R. R. Williams, Jr., manager, Mining Department, Colorado Fuel & Iron Corp.

First speaker of the afternoon was L. R. Flicker, senior safety engineer, Permanente Cement Co., who outlined basic information needed to enlist top management's active support of a safety program. He brought out the basic concepts of such a program and outlined and discussed briefly the major points in the establishment of a safety program. Flicker showed that responsibility for safety starts with top management and emphasized that a safety program in any plant must secure attention equal to or better than that given production problems. Any company can develop a satisfactory program if it will recognize the total cost of accidents and do something about it, he declared.

Speaking on "Safety Incentives," E. C. Leonard, safety director, Inland Steel Co. said, "The human element is a major factor in accident prevention work today, and carelessness and poor judgment are the primary cause in nearly 90 percent of accidents." To cope with this problem, he said, a safety program must be designed to develop employee interest in safety and to maintain safety consciousness in the individual workers. Incentive systems have proven effective in arousing and maintaining interest in safety. Leonard stated that such a program must allow employees to receive awards frequently enough to maintain interest, yet not so frequently as to cause monotony, and that any incentive program should be based on group participation to emphasize the impor-

tance of teamwork in attaining good safety. He concluded by saying that an incentive program should not be used to short-cut a well-rounded safety program. There is no easy method of preventing accidents and every conceivable approach must be used in the continuing fight against accidents.

John W. Warren, chief ventilation and industrial hygiene engineer, The Anaconda Co., presented the next paper which was titled "Industrial Hygiene, Dust Elimination Methods and Equipment." In addition to using slides, Warren effectively utilized an impressive visual demonstration to develop the theme of his paper. He pointed out the importance of dilution



Next year—Salt Lake City

and ventilation in industrial hygiene and discussed innovations in ventilation and air conditioning in underground mining operations. He discussed unique methods of capture, transport and retention as dust control in mining operations, especially where large tonnages are dumped into storage pockets.

The final address of the afternoon, "Silicosis Research," which had been prepared jointly by Henry N. Doyle, assistant chief, Occupational Health Program, Department of Health, Education and Welfare, and Robert H. Flinn, chief, Division of Health, U. S. Bureau of Mines was presented by Mr. Doyle.

"Although in the past a tremendous amount of research by Government and private agencies has been devoted to the study of silicosis, a recent study on the prevalence of silicosis indicates that there is still a significant problem in the mining and manufacturing industries," Doyle said. He asserted that sufficient evidence has been uncovered to show that either the application of dust control is not universal, or that other factors, such as the adequacy of present standards, the influence of particle size and the actual toxicity of various forms of silica, may be involved. A notable achievement of the past few years, Doyle said, has been the development of a

system of classification of chest X-ray films of pneumoconiosis. Recent studies with spirogram tracings indicate that the technique may be a useful screening test to detect early pulmonary function abnormalities, even before subjective or X-ray changes are apparent.

URANIUM EXPLORATION AND MINING

WITH Tom Evans, chief mining engineer, Atchison, Topeka & Santa Fe Railway Co., presiding the Uranium Exploration and Mining Session got under way on Wednesday afternoon.

Allan E. Jones, manager, Grand Junction Operations Office, AEC, spoke on uranium developments in the western United States. He expressed the hope that the classification of information relating to plant capacities and concentrate production would soon be accomplished thus providing the mining industry with the opportunity for a completely unrestricted exchange of ideas and experience and uranium technology. The continued increase in ore reserves in older mining areas, and discoveries of large ore bodies in new areas have required milling capacities far greater than could be foreseen a few short years ago. Jones stressed as highly significant the fact that new metallurgical processes which have been developed in the Commission's laboratories and pilot plant have been proven in practical application in the field.

Major geology of the uranium deposits at Ambrosia Lake was the subject of a comprehensive study presented by Robert G. Young, geologist, Grand Junction Operations Office, AEC, in which he traced the discovery and development of the district. He showed illustrations depicting regional stratigraphy and structure, and described what is presently known of the area's mineralogy and ore deposits. His conclusions are that most uranium deposits occur in traps near the crests of anticlinal or domal structures which controlled either directly or indirectly the movement of both hydrocarbons and ore solutions in this district.

John P. Herndon, mine superintendent, Jackpile Mine in a paper co-authored with Albert J. Fitch, manager, New Mexico Operations, The Anaconda Company, described Anaconda's Jackpile Mine. He told how the original discovery was made and how a drilling campaign was continued on an extended grid pattern to the north and away from the known ore body to discover a multimillion ton deposit that dwarfed the original find. Such considerations as the blending of ores to insure mill feed of uniform metallurgical characteristics and the high degree of selected mining em-

ployed at the mine were discussed by the authors.

The story of the Gunnar Uranium Deposit at Lake Athabasca which was put into production 38 months after its discovery was related by J. N. Botsford, mine manager, Gunnar Mines Ltd., Canada. The pipe-shaped ore body of disseminated pitch-blend and secondary uranium minerals in a brecciated syenite is currently being mined by open pit methods and will later be developed as an underground producer. The measures taken to overcome its remote location and severe cold weather conditions are of particular interest.

G. R. "Bufalo" Kennedy, vice-president and general manager, Rio de Oro Uranium Mines, Inc., pondered on the matter of "What the Years after 1960 Hold for the Independent Uranium Prospector and Miner." Pointing out that surface outcrops in favorable formations have been carefully explored, he stated that exploration for uranium has entered a new phase—deeper drilling and blind drilling in known favorable formations and structural features. The problem is how to keep the domestic programs strong, profitable and self sufficient during the transition from military demands to peaceful uses of this future energy source.

Paul Jones, chairman, Navajo Tribal Council, in an extemporaneous talk made it clear to the industry that the Navajo tribe is greatly interested in the exploration and development of uranium ores as well as all other mineral resources on their reservation in the four corner area. The Navajos have set up an executive committee to handle all mining business through their own engineers, and which has authority over all mineral dealings for the tribe. Dealings may be expedited by going directly to this executive committee rather than to the federal government which can only refer tribal business matters back to the tribal committee. The Navajos are not interested in any speculators but are interested in sound business dealings which he is confident can be of great mutual advantage to the tribe and the industry.

URANIUM MILLING

TUESDAY morning the session on "Uranium Milling" gave listeners the opportunity to hear about the latest technology of the vigorous, young uranium industry. Marvin L. Kay, vice-president and general manager, Climax Uranium Co., who made the arrangements for subjects and speakers presided as chairman.

Don C. Seidel, chief metallurgist, Union Carbide Nuclear Co., presented a report on "Uranium Metallurgy on the Colorado Plateau." The purpose

of his report was to list and evaluate some of the unit operations and processes used in uranium milling and to outline a few of the problems and possibilities of uranium extraction. Several flow sheets were presented for uranium and vanadium processes.

"Uranium Milling at the Bluewater Plant, The Anaconda Company, New Mexico Operations" was the subject of a paper by E. C. Peterson, assistant manager, and D. C. Matthews, chief metallurgist for Anaconda. Their report gave a description of both the alkaline and resin-in-pulp plants used at the Anaconda Bluewater Plant. Housing and employee welfare were also discussed.

The next paper on research and new developments in uranium processing was written by C. K. McArthur, project manager, and John S. Breitenstein, technical director, National Lead Co. McArthur delivered the paper presenting several recent developments in the uranium milling industry. Among the processes discussed were: Eleux Process, Solvent Extraction of Acid Leach Liquors, Solvent Leaching, Recovery of Uranium from Uraniferous Lignite, and Carbonate RIP Process.

This was followed by a presentation by E. H. Crabtree, director, Colorado School of Mines Research Foundation, Inc. on "Solvent Extraction" written by himself and C. J. Lewis also of the Colorado School of Mines Research Foundation. Crabtree presented the technological aspects of solvent extraction, or liquid-liquid extraction as applied mainly for uranium, but reference was also made to its possible use for other metals.

The final paper of the session, "Plant Application of Solvent Extraction in Uranium Milling" was presented by Woodrow Knott, plant manager, Climax Uranium Co. He discussed solvent extraction of uranium from acid leach liquors with a complete flow sheet. Various items of equipment and their sizes were itemized.

TAX CONFERENCE

FOLLOWING the close of the Convention and Exposition, the Tax Conference, under the chairmanship of H. B. Fernald, discussed many of the technical provisions of the Internal Revenue Code affecting the mining industry. Reports were also received on the outlook for Federal tax legislation, AMC Tax Committee activities during 1956, recent court cases concerning percentage depletion, and the present status and outlook with respect to regulations affecting the mining industry.

The more than 75 tax specialists in attendance heard an interesting discussion of many of the tax problems facing the industry.

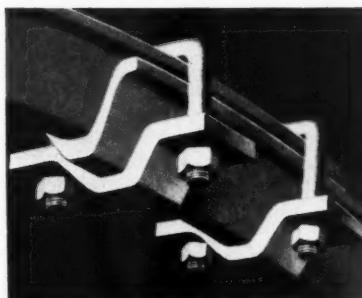


It's just good economics to use Bethlehem Yieldable Arches

Where conditions underground are difficult, mine roof support becomes a real problem. And that's where Bethlehem's Yieldable Arch sets can do an efficient job, and an amazingly economical one.

It's the "give" in the Yieldable Arch that does the trick. An individual arch is made up of segmental sections which nest into one another at the ends to form an overlapping joint. The joint is secured by U-bolt clamps drawn up tight enough to hold fast under normal loads. Struts are installed between arches to provide lateral stability.

When pressures become excessive, the joints yield and permit the overburden to settle slowly and form its own pressure arch. Thus safety



in the mine is maintained, mining operations can continue, and maintenance costs are reduced.

When the arch sets have served their purpose at one point, they can be salvaged and re-used elsewhere. Add this recoverability feature to the fact that Yieldable Arches far

outlast timber supports, and you can see that it's just good economics to install the Yieldable Arch. One ore mine recently estimated that their Bethlehem arch sets paid for themselves within six months!

If you are interested in talking about the Yieldable Arch for your mines, or if you would like to learn how it is performing for others, one of our engineers will be glad to meet with you at your convenience. You can reach him through the nearest Bethlehem sales office.

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Operators Corner

System Approach to

Two-Way Radio Maintenance

By JOSEPH JATIS

Assistant to National Service Manager
Motorola Communication and Electronics, Inc.

EXPERIENCE has shown that there is a particular way of maintaining 2-way radio communications equipment that is superior to others in achieving maximum operating efficiency and reliability at least cost.

This procedure is known as "System Maintenance," which simply means that the inspection and maintenance of all units constituting the whole is conducted in an established and orderly fashion. And it goes without saying that the procedure should be conducted at regular intervals in order to yield all of the well-known benefits of preventive maintenance.

All radio communications systems used in the mining industry include integrated assemblages. A failure in any one of these would constitute a failure of communications. However, there are three major factors in a mobile radio communications system which require attention:

- (1) The primary power source
- (2) The basic radio units
- (3) The antenna system

Any successful maintenance program must include the *entire* system. It would be of no consequence to maintain the basic radio units at top efficiency only to ignore the primary power or the antenna. A failure in either one results directly in a failure of radio communications. Therefore, to be successful in preventive maintenance, a program should be developed and closely followed on a basis of all-inclusive system maintenance. Such a program should include a periodic check on *all* the factors constituting a radio communications system as follows:

Primary Power

Automobile or truck batteries almost never go dead without warning. They usually fail after a long period of undercharging or overcharging, lack of water, poor connections or old age, with many indications of the approaching end.

From the radio technician's point of view, the voltage available at the battery terminals under load is the telling point. A fully charged lead-acid battery under a given load may show a measured voltage of approxi-

mately 6.4 v in the case of a "six-volt" battery and 12.8 v in the case of a "twelve-volt" battery. An old sulfated or undercharged battery may show voltages of only 6 v or lower. These are *battery terminal voltages*, not the voltage present at the radio units. The terminal voltage at the units in the trunk of the car will probably be 0.5 to 0.7 v lower when a transmit current of about 40 to 60 amp is being drawn.

One of the good methods of checking primary power trouble is to measure battery voltage both at the terminals of the battery and at the equipment. An immediate drop in voltage of more than 0.2 v measured at the battery on a short transmit cycle would indicate a battery in poor condition. A drop of more than 0.7 v measured at the units would point to troubles in the primary circuit—cable, fuse, block, relay or chassis return. This voltage drop is excessive and should be investigated fully.

"A" relay contacts wear out, requiring replacement.

Fuses get tired, sometimes even when new they may have too much resistance. Check and replace if voltage drop exceeds 0.1 v.

Connections loosen as a result of vibration. Tighten or resolder.

Fuse Holders also loosen because of vibration. They lose their temper because of heat resulting from poor contact. Acid causes corrosion and accumulation of oil and dirt increases contact resistance. Remedial action is to clean contacts, tighten or replace.

Keeping voltage drops to a minimum in a primary circuit is essential to good system operation. The same rules apply to other sources of power. Dry batteries especially must be checked under full load. Some knowledge of the number of hours of use must be available as an indication of when they most likely will need to be replaced.

A-c sources of power are by no means free of trouble. Primary voltages are always suspect in a-c circuits as they can often be too high as well

as too low. In some cases application of voltage regulators may be necessary. Loose connections on fuses occur even in a-c circuits. A hot fuse or connection is always a key point for a good maintenance man to investigate.

Primary power sources should be the first check points in preventive maintenance procedures and should be checked periodically.

Unit Assemblages

These include transmitter, receiver, power supply, etc. In maintaining unit assemblies the secret lies in knowing what to do and *what to leave alone*. Few adjustments need to be made regularly in transmitter and receiver units. To catch a maximum number of incipient troubles, the technician must use his eyes, his ears, his sense of touch, and meter measurements, as well as his good judgment and past experience.

Basically four types of observation are required:

Listening Tests

An experienced technician can often detect warnings of impending trouble by noting the audio quality, the noise background and the squelch operation in relation to the settings of the volume and squelch controls. He will come to know the normal signal level he should obtain at given locations with selected stations in a particular system. Degradation of performance will be immediately apparent to the technician who checks the set periodically, whereas the steady operator may become accustomed to a gradually degraded performance.

Visual Inspections

Look for loose bolts, screws and clamps, worn microphone cords, burned out pilot lights, arcing at any point, loose or broken components, burned resistors, or loose connections. A good visual inspection not only is a means of quickly locating the source of trouble, but may prevent more serious trouble from developing later.

Touch

The fingers are good detectors of improper temperature conditions. Fuses, fuse holders, crystal ovens, transformers and relay coils which are too hot mean trouble. Also, a cold crystal oven, tube or resistor that should normally be warm is probably in trouble. Such tests are quick and should be used often.

Meter Measurements

Actual quantitative measurements of "A" and "B" voltages, grid and plate currents, power output, frequency and deviation have no substitute; their meaning is definite. Experience will indicate to what degree variation can be tolerated.

Good test equipment is essential to good system performance. Test equipment is not an expense—it is an investment. Its cost can be recovered in the saving of time and material on any system operation. It is a tool to do the work quicker, more easily and better.

Antennas

Visual check of antenna, line and tower lights, mobile antenna mount, cable, and connectors should be made periodically, as well as a meter check to find any open or shorted lines or high standing wave ratios. Remember that the antenna must efficiently radiate the power developed in the transmitter chassis and also transfer

times deteriorate to an amazing extent before complaints arise. However, the technician should know to what extent he can allow transmitter power output and receiver sensitivity to drop without degrading operation. It is perfectly sensible economy to get all the performance possible out of each component, but there is always a danger point below which performance must not be allowed to sink! Only frequent inspection will show when equipment is approaching that point.

Netting

Netting of receivers and transmitters in any system is more important than usually realized. The term "netting" means that all receivers and transmitters in a given system are aligned on the same frequency. With modern selectivity requirements, it is more than ever necessary to tune every receiver *exactly* to the station it must receive. Careful "netting" of all units in an integrated system to the correct frequency is a first order requirement of a modern communications system and will eliminate a prime cause of poor performance.

Frequent checks of transmitter deviation will also do much to improve system operation. Frequency and deviation checks are more important from a system operation standpoint than the twice-yearly F.C.C. regulations seem to indicate. The technician



Primary power sources are the first check points in preventive maintenance procedure

to the receiver the minute voltages picked up from the distant transmitter to produce a good audible signal. Failure of the antenna or line is a failure of the communications system.

Some radio communications systems are in operation with no safety factor whatever, and the slightest drop-off results in a trouble call. Such systems cannot be maintained at a reasonable cost. On the other hand, many systems have a quite adequate safety factor and these systems some-

should be sure that transmitters are swinging a normal ± 1 kc. for standard channel and ± 5 kc. for split channel operation. Under-deviation does not develop the full advantages of frequency modulation.

A good rule to follow is to check performance frequently and make adjustments only when actual tests and measurements show improper operation. Adjust nothing without meters and signals to indicate actual conditions. This is one area in which your ear isn't a good meter.

Check List

A good preventive maintenance program would require a complete system check *at least* every three months. In a general way the following items should be part of any preventive maintenance routine.

- (1) Clean and dust thoroughly.
- (2) Check primary voltage circuits.
- (3) Measure power output of transmitters.
- (4) Measure sensitivity of receivers.
- (5) Check meter readings at the metering positions of transmitters and receivers.
- (6) Check audio output of receivers and audio input to transmitters.
- (7) Check operation of all relays.
- (8) Measure frequency and deviation of transmitters.
- (9) Check and adjust frequency netting of the entire system.
- (10) Check all accessories; control heads, cables, microphones, pilot lights, etc.
- (11) Check the antenna system.
- (12) Check and adjust remote control levels.
- (13) Check power supply output voltages.
- (14) Actually make an operational listening test of transmission and reception.

The success of preventive maintenance procedures will depend on the attention paid to each detail of the system maintenance program. Such a program intelligently applied as a planned, periodic, complete system inspection will pay off in dollars, as well as in continued good system operation. It will give greater satisfaction in operation of radio communications and it will insure continued reliable communications at all times. Best of all, perhaps, you will have the inner satisfaction of a "job well done."

Summary

A good preventive maintenance program will be successful if the radio technician but follows some basic rules diligently such as:

- (1) Maintain primary power at proper levels.
- (2) Check system "netting" frequently.
- (3) Be observant and react to senses: Hearing, seeing and feeling.
- (4) Keep equipment clean and dry.
- (5) Keep individual records of each unit.
- (6) Believe the user. If the user says the operation is faulty, you may be quite sure the system is not working properly even though the description of the trouble may not be quite accurate, or cursory test may indicate that everything is all right. Search out and find the difficulty.
- (7) Follow your preventive maintenance program consistently; perform each recommended procedure without fail.



Wheels of GOVERNMENT



As Viewed by HARRY L. MOFFETT of the American Mining Congress

AS this is written the election race is in its final stages and little activity of specific interest to the mining industry is apparent in Washington. While most observers freely predict that the Eisenhower Administration will be returned to office, they are reluctant to predict the outcome of Senate and House races which will decide the makeup of the next Congress. Regardless of the outcome, it is certain that many new faces will be seen in the Nation's Capital next year—and this may include shifts in top executive posts.

In the new Congress legislation of interest to industry will probably get off to a slow start. As is the case when there are major changes in the composition of Congress, time will be needed to reorganize the committees which do the real spade-work on legislation. The Congress will also have to wait messages from the President on his legislative program and the budget for the coming fiscal year. As a result major proposals of interest to mining are not likely to be before Congress until late January or early February.

Minerals Policy in Offing

On more than one occasion in the past few months, Interior Secretary Fred Seaton has made it clear that the Department of Interior will submit recommendations to the next Congress early in the year for a national minerals policy.

He gave some hint as to what form the policy recommendations may take when he spoke at the recent Los Angeles meeting of the American Mining Congress. He said the Department was determined to do everything within its power to maintain a vigorous domestic mining economy. He told the mining industry that the hard core of a long-range minerals program already exists. Included in this program, he said, are geologic and topographic mapping, basic research, studies in the improvement of mining and beneficia-

tion, and research in the development of new products.

Seaton said there are three steps in projecting a long range program: (1) intensification and expansion of the present "hard core" activities, (2) prompt release to industry of any new technology developed from research, and (3) re-examination of the impact of the tax laws and other Government fiscal measures upon the mining industry.

He indicated that the Department hoped to find a way to enlarge the scope of the Defense Minerals Exploration program and to make it permanent, and hinted that efforts will be made to lessen the impact of imports upon domestic mining and to improve the tax climate for the industry. He said that if these goals are achieved, the Federal Government will be making a real contribution to the strength and vigor of our domestic mining industry.

Tariff Study Completed

A House Ways and Means subcommittee, created to study the impact of foreign trade policies upon domestic industry, has completed its task and expects to visit Europe this month for the purpose of obtaining the views of U. S. businessmen abroad, foreign governments, and representatives of our own Government on our foreign trade policies.

During the course of the hearings, representatives of the lead and zinc industries pointed out that these industries had failed in efforts to obtain relief from excessive imports under provisions of the Trade Agreements Act even though the Tariff Commission had unanimously recommended such relief. They urged Congress to revise the "escape clause" under the Act to require that the Tariff Commission report its findings to the Congress rather than to the President for approval or disapproval.

Spokesmen for the coal industry and the independent petroleum pro-



Washington Highlights

MINERALS POLICY: In offing

TARIFF STUDY: Hearings completed

FREIGHT RATES: 15 percent increase sought

COAL RESEARCH: Hearings to resume

TAX STUDY: Scheduled this month

COAL WAGES: New agreement signed

MINE SAFETY: Field hearings open

COAL EXPORTS: FMB approves ships charter



ducers urged Congressional action to limit residual oil imports. They declared that the Government's present voluntary formula for limitation of such imports had proven a failure. ODM Director Arthur Flemming told the Committee that his agency is getting close to a decision on whether the voluntary formula for limiting oil imports should be changed. Immediately after the close of the hearings he announced that ODM had scheduled hearings for late October on a petition of independent oil producers for a determination of the effect of imports upon the domestic industry.

The Ways and Means subcommittee plans to submit a report on its studies early in the next session.

Freight Rate Hike Sought

Eastern and Western railroads have petitioned the Interstate Commerce Commission for a 15 per cent increase in freight rates. If approved for all railroads, the new rates would cost shippers as much as one billion dollars annually. The Southern carriers have not joined in the plea for higher rates.

The ICC has announced its timetable for considering the rail's petition, which makes it quite plain that a decision will not be made before late January or early February. Hearings on the petition will not be held

until January 15, 1957 and final oral argument will not be presented until January 22. Upon conclusion of the hearings and argument the Commission will take the matter under study, and if past action in this field is indicative, will probably not decide the issue for a week or two.

The railroads filed their statements in support of the petition in October, but opponents of the proposed increase have until December 14 to make their views known.

Meanwhile, the carriers have also asked the ICC to reconsider its order suspending increased demurrage charges and changes in demurrage rules which were due to become effective September 1. The ICC has suspended the proposed changes until March 31, 1957.

Coal Research Hearings to Resume

Chairman Ed Edmondson (Dem., Okla.) of the House Interior subcommittee on Coal Research, has announced that hearings will be held by the Committee in seven States this month.

He said hearings will be held at Henryetta, Okla.; Wilkes-Barre, Pa.; and Ebensburg, Pa., with additional ones to be scheduled for cities in West Virginia, Kentucky, Virginia, Colorado and Utah. It is expected that the Manufacturers Division of the American Mining Congress will testify at one of the Pennsylvania hearings, with J. D. A. Morrow, chairman of the board of the Joy Manufacturing Co. appearing on its behalf. Previously the Coal Division of the Mining Congress had presented its views to the Committee at hearings held in Washington last July.

Members of the subcommittee include Reps. Wayne Aspinall (Dem., Colo.), Lee Metcalf, (Dem., Mont.), Stewart Udall (Dem., Ariz.), John Saylor (Rep., Pa.), William Dawson (Rep., Utah), and Edgar Chenoweth (Rep., Colo.).

Tax Study Due This Month

Hearings will be held by a special subcommittee of the House Ways and Means Committee this month with a view to determining what technical errors were made in the 1954 Revenue Code and what "unintended advantages" were afforded taxpayers. The committee will also study administration of the tax laws.

Subcommittee chairman Mills (Dem., Ark.) stated that the committee will try to determine what Congress really intended to be part of the tax base, and to make clear what the present law really means. He said the committee will decide next year what to do about some of the special advantages that Congress put into the tax laws.

It is understood that Treasury De-

partment and Congressional experts are preparing a list of "unintended advantages" for the committee. It is expected that the committee will leave until next year consideration of such items as depletion allowances, tax treatment of cooperatives, dividend tax relief, capital gains taxation, and accelerated depreciation of business property for tax purposes.

New Coal Wage Agreement

A new wage contract has been agreed to in the bituminous coal industry. The contract, which runs for one year from October 1, provides a \$2-per-day wage increase, of which \$1.20 became effective October 1. The remaining \$.80 goes into effect on April 1, 1957.

Under the new agreement, the number of vacation days are increased from 12 to 14, with 11 of them in the June 28-July 8 period, for which \$180 will be paid. The remaining three vacation days, for which \$40 will be paid, will be observed December 24, 26 and 31. The contract also provides for double time or double rate for holidays when worked.

The hike in the pay of the coal miners quickly brought forth an announcement that prices of coal would be raised a minimum of thirty-five cents a ton in order to return to producers the increased cost of mining bituminous coal.

Mine Safety Hearings Open

A special subcommittee of the House Labor Committee on safety in metal and nonmetallic mines has opened field hearings on mine safety. One hearing has been held in Butte, Mont., at which representatives of mine opera-

tors and mine labor have testified. Mine management pointed to the excellent safety record maintained in the metal and nonmetallic mining industries and stated that mine safety was a matter that was being well handled by the States.

Chairman Metcalf (Dem., Mont.) has announced that he expects to call the committee together in Washington, either this month or next, for full-scale hearings and will invite representatives of mineral producers, mine labor, the U. S. Bureau of Mines and the U. S. Public Health Service to testify. He has told newsmen that the hearings will probably result in the drafting of Federal mine safety legislation which will be introduced at the next session of Congress.

Members of the subcommittee are Reps. Landrum (Dem., Ga.), Elliott (Dem., Ala.), Rhodes (Rep., Ariz.), and Fjare (Rep., Mont.).

Federal Ships Chartered

The Federal Maritime Board has authorized American Coal Shipping, Inc. to charter 30 Liberty ships from the mothball fleet to carry coal to Europe.

In granting the charter rights, the Board imposed several restrictions. The principal one provided that the company shall not use the ships to carry out any commodity other than coal nor carry back any commodity other than ore unless it first obtains the approval of the Board. It also barred the company from engaging in coastwise trade. The Board told the company that it expects to have a report of progress being made in its plans to build specialized coal-carrying vessels.





Personals

S. H. Williston has been elected president of the Western Governors Mining Advisory Council, a group formed to advise western governors on mining matters. Other officers elected include **C. H. Murphey**, Santa Fe, N. M., vice-president, and **Louis D. Gordon**, Reno, Nev., secretary.

Robert D. Cullen has been appointed general sales manager of Pennsylvania coals for Pittsburgh Consolidation Coal Co., according to **J. W. Kepler**, sales vice-president. Cullen, who has been Pittsburgh district sales manager, assumes the duties and functions of **Harry N. Smith**, recently retired. Cullen has been



R. D. Cullen

associated with the company since 1933.

J. Edward Stewart has been appointed to replace Cullen as district sales manager. He has been with Pittsburgh Consolidation Coal Co. and its predecessor companies since 1940.

Advancement of six officials in the Anaconda Company's reduction plant, Anaconda, Mont., has been announced by **William E. Mitchell**, manager.

Frank H. Day, superintendent of the Cananea Consolidated Copper Co. smelter at Sonora, Mexico, has been promoted to assistant general superintendent of the Anaconda plant in charge of the fire metallurgy department. **John R. Moore**, project and development engineer, has been promoted to assistant general superintendent in charge of the hydro metallurgy department. **J. Hollis McCrea**, superintendent of smelting, has been advanced to metallurgist, succeeding **R. G. Bowman**, who retired.

Charles M. Holstrom, superintendent of the zinc department, succeeds Moore as project and development engineer. **F. Adolph Salomonson**, superintendent of the roasting department, has been promoted to superintendent of the zinc department, suc-

ceeding Holstrom. **Emil S. Kramlick**, superintendent of the reverberatory department, is the new superintendent of smelting, succeeding McCrea.

George C. Trevorrow, long identified with safety work in the coal industry, has been appointed safety director of the Bituminous Coal Operators Association. He succeeds **Marlin J. Ankeny**, who resigned to become director of the U. S. Bureau of Mines. A graduate of Penn State College, Trevorrow was connected with coal companies in Western Pennsylvania for a number of years. He was most recently associated with the Paul Weir Co., Chicago, as a mine consultant in Turkey.

E. M. Lindenau has returned from Colombia where he was manager of Compania Minera Choco Pacifico, one of the largest dredging companies in the world.

At the annual meeting of Island Creek stockholders and directors, **James L. Hamilton** was elected executive vice-president of the Island Creek Coal Co.; Island Creek Fuel & Transportation Co.; vice-president, Island Creek Coal Sales Co.; executive vice-president, United Thacker Coal Co.; executive vice-president, Queen City Coal Co.—the latter companies being wholly-owned subsidiaries of the Island Creek Coal Co.

Hamilton's first connection with Island Creek Coal Co. was made in 1949 when he served as vice-president in charge of operations, not only for Island Creek, but also for the subsidiary companies, Pond Creek Pocahontas Co. and the Marianna Smokeless Coal Co. When Pond Creek Pocahontas Co. and Marianna Smokeless Coal Co. merged into the Island Creek Coal Co., he continued as vice-president in charge of operations of Island Creek's subsidiaries until his recent election as executive vice-president.

Appointment of **Royal P. Anderson** as plant engineer, Department of Mills, has been announced by **L. C. Jones**, chief engineer, Utah Copper Division, Kennecott Copper Corp. Anderson succeeds **C. T. Jensen** who died August 21, 1956. The new plant engineer was formerly assistant superintendent of the Garfield Water Co.

Armour A. Sizer, widely known in coal and allied industries throughout the East and Midwest, retired October 1 as division sales manager for Pocahontas Fuel Co., Inc. He has worked in the industry since 1907.

Secretary of Commerce Sinclair Weeks has announced the elevation of **Horace B. McCoy**, veteran career service official, as administrator of the Commerce Department's Business and Defense Services Administration. McCoy, deputy administrator of the BDSA, succeeds **Charles F. Honeywell**, who resigned.

John W. Hanley has been appointed chief metallurgical engineer for Cerro de Pasco Corp., it was announced by

Robert P. Koenig, president.

Hanley was formerly in charge of coordinating the corporation's zinc development program, a position he was appointed to after serving for several years as assistant manager of the Peruvian operations of the corporation. He will render advisory and consulting services on metallurgical matters and will have staff control over all of the metallurgical functions and activities of Cerro de Pasco Corp. He will continue to have his office in New York.

Robert C. Norton, chairman of the board of Oglebay, Norton & Co., iron

ore, coal and lake shipping firm, has announced two executive appointments. **W. D. Hamilton**, formerly coal mines manager, has been made vice-president—coal operations. **M. A. Williams**, formerly general superintendent—coal mining, has been named general manager—coal operations.

Robert T. Wilson who has been mining engineer at the Jefferson City, Tenn., zinc mine of Tennessee Coal & Iron Division of United States Steel Corp., has been named general superintendent of the mine. He succeeds **Frank B. Brophy**, who retired recently.

Joseph A. Miller succeeded Wilson as mining engineer and **Charles E. Piper III** succeeded Miller as mining superintendent.



W. D. Hamilton

Royale J. Stevens, who has spent most of his life in Australia and South Africa, has been named consulting engineer on the staff of S. D.

Michaelson, chief engineer, Western Mining Divisions of Kennecott Copper Corp. The engineering department's headquarters are in the Kennecott Research Center building near the University of Utah campus.

Prior to accepting the Kennecott position, Stevens was assistant manager of the Roan Antelope Copper Mine in Luanshya, Northern Rhodesia.

Robert D. Saltsman, formerly resident mining engineer for Youngstown Mines Corporation, Dehue, W. Va., has been employed by Bituminous Coal Research, Inc., as a project engineer. He is currently working on coal-burning equipment sized for commercial and small industrial applications.

Jackson R. Jones has been named to the board of directors of the Natural Power Corp. of America, it was announced by Loren Keanan, president of the firm. Natural Power, with headquarters in Salida, Colo., has copper, rare earth and uranium mining holdings in this country.

Clyde E. Weed, president of The Anaconda Co., has announced the appointment of Mord Lewis as vice-president of Anaconda Aluminum Co., a 95-percent-owned subsidiary.

Lewis was formerly assistant to the vice-president in charge of operations of The Anaconda Co. He joined Anaconda in 1926 after receiving a Master of Science degree in geology from the University of Virginia.

Crucible Steel Company of America has appointed John E. Ellis to the newly created position of superintendent of maintenance at the company's Crucible, Pa., mine, according to an announcement by George E. Muns, manager, Fuel Division.



William B. Ross, president of Philadelphia Coke Co. since 1949, has been elected a vice-president of Eastern Gas & Fuel Associates by the board of trustees. He will be in direct charge of the Everett Coke Plant and Blast Furnace and the Philadelphia Coke Plant. Ross will also be responsible for coordinating all of Eastern's coke plant operations, including those of The Connecticut Coke Co. He remains as president of the Philadelphia Coke Co.

Appointment of Luther G. Hendrickson as supervisor, field development for U. S. Steel's Oliver Iron Mining Division Research Department, has been announced by R. J. Morton, manager of research. Hendrickson first became associated with Oliver in 1951 as a chemical engineer at the research laboratory in Duluth. He was transferred to the company's Pilotac taconite concentrating plant

in Mountain Iron in 1953 where he served as a development engineer until receiving his present appointment.

Frank H. Madison, for many years chief of the Mining Section (Natural Resources) of the Internal Revenue Service and principal engineer (Mining) in the U. S. Treasury Department, retired from Government service November 1 to become an associate member of Behre Dolbear & Co., Inc., Mining, Geological and Metallurgical Consultants of New York. He is widely recognized as a leading expert on valuation, depletion and depreciation in relation to income tax matters.



— Obituaries —

Dr. Charles K. Leith, 81, a leading geologist and adviser to the Government on minerals and metals, died September 13.

A member of several Government advisory boards and the author of numerous articles and books, Dr. Leith was chairman for 33 years of the department of geology at the University of Wisconsin, retiring in 1945.

He began his career as assistant geologist with the United States Geological Survey in 1900. During World War I he was mineral adviser to the Shipping and War Industries Boards in Washington and also to the American Commission to Negotiate Peace in Paris in 1919. From 1929 to 1938, Dr. Leith was chairman of the Mineral Inquiry. In the 1930's he was also a member of the Science Advisory Board and the Business Advisory and Planning Council for the Commerce Department. He was vice-chairman of the Planning Committee for Mineral Policy and chairman of the Mineral Advisory Committee of the Army and Navy Munitions Board for many years.



During World War II, he was consultant on minerals for the National Defense Commission, the Office of Production Management and the War Production Board. He was also chief of the metals and minerals branch,

office of production research and development of the WPA.

More recently, Dr. Leith was a consultant to the Security Resources Board, the Research and Development Board, and the Atomic Energy Commission.

Last April, he was cited by the AEC for outstanding service on his retirement from the Combined Development Agency, a joint British and American organization set up in 1944 to procure uranium and thorium supplies.

William Henry Holland, 85-year-old coal operator from Winona, W. Va., died August 11. He operated the Ballangee Coal Co. with his father and brother and later organized Lookout Southern Coal Co. and operated Boone Coal Co. He helped reorganize the New River Coal Operator's Association in 1920.

Donald B. Gillies, 83, internationally known mining expert, died September 29. He gave almost 50 years of continuous service to Republic Steel Corp. and Corrigan, McKinney Steel Co. (a Republic predecessor organization.)

Mr. Gillies was a vice-president of Republic Steel until 1947, after which he continued a full and active business life as a mining consultant for Republic until his retirement this year. His most important contributions to Republic had to do with raw material reserves. He was responsible for that company entering into iron mining in Liberia and within the past two years he had been instrumental in exploring an important deposit of rutile in Mexico.



Crucible Steel Company of America has appointed John E. Ellis to the newly created position of superintendent of maintenance at the company's Crucible, Pa., mine, according to an announcement by George E. Muns, manager, Fuel Division.

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1957 Coal Show

Plans being made for another outstanding convention

THE rapidly growing world-wide demand for American coal and the increasing cost of mine labor are combining to make coal producers in this country step up the battle of mechanization so they can hold their hard won markets. It comes as no surprise then to learn of the great interest in the planning of the 1957 Coal Show of the American Mining Congress, which will be held in Cleveland's Public Auditorium next May 13-16.

Under the chairmanship of A. R. Matthews, president, Pocahontas Fuel Co., Inc., the Program Committee for this great affair will hold its first meeting shortly to select subjects for discussion at the Convention. The Committee is made up of a wide cross-section of the coal industry—including operators from the major coal fields, representing both deep and strip mines, together with a representative group of mining equipment manufacturers.

The coal industry is seeing many new and in some cases startling ad-

vances in mining and preparation techniques. These will be the subject of many of the papers that will be presented and discussed in Cleveland. The important topics of health and safety, management problems, and maintenance will also be fully developed. An intensive campaign for suggested topics to be presented at the Convention has been conducted, and the Program Committee will have hundreds of suggestions to guide it in organizing the sessions for the 1957 Coal Show.

In addition to a fine program, the 1957 meeting will feature the biennial Exposition of mining equipment. The Coal Show is the only place where it is possible to inspect and compare so many competitive pieces of equipment right on the spot. Manufacturers of mining equipment are leaving no stone unturned to make this the grandest and greatest Coal Show ever held and their efforts mean that those who attend will get more out of the meeting than ever before.



A. R. MATTHEWS
Chairman

The lighter side will not be forgotten either. The 1957 American League schedule permitting, there will be another "Baseball Night." And don't forget the famous Coal Miners Party which this year will be bigger and better than ever.

Now is the time to make plans to attend this important industry meeting. A record attendance is expected and hotel reservations should be made as soon as possible. Write the Cleveland Convention Bureau, 511 Terminal Tower, Cleveland 13, Ohio, at your earliest convenience.

Members of 1957 Program Committee

A. R. MATTHEWS, Pocahontas Fuel Co., Inc. (*Chairman*)
I. N. BAYLESS, Union Pacific Coal Co.
R. K. BEACHAM, Ayrshire Collieries Corp.
C. R. BOLL, Cummins Engine Co., Inc.
A. P. BOXLEY, Eastern Gas & Fuel Associates
N. T. CAMACIA, Island Creek Coal Co.
S. A. CAPERTON, Slab Fork Coal Co.
E. C. CARRIS, Consulting Engineer
E. R. COOPER, Jones & Laughlin Steel Corp.
C. C. CORNELIUS, Joanne Coal Co.
W. J. CRAWFORD, Enos Coal Mining Co.
WM. CRAWFORD, Powellton Coal Co.
E. E. CRISWELL, Compass Coal Co.
C. M. DONAHUE, Mine Safety Appliances Co.
W. STUART EMMONS, Hulburt Oil & Grease Co.
WM. A. GALLAGHER, Stonega Coke & Coal Co.
THERON G. GEROW, Mining Consultant
D. N. GRIFFIN, Deister Concentrator Co.
C. M. GUTHRIE, Peabody Coal Co.
R. G. HEERS, Kaiser Steel Corp.
D. K. HEIPLE, LeTourneau-Westinghouse Co.
JAMES HYSLOP, Hanna Coal Co.
DAVID INGLE, Ingle Coal Co.

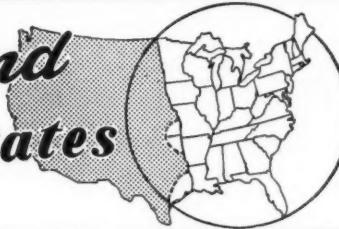
W. C. JONES, Jeddo-Highland Coal Co.
J. M. KERR, Berwind White Coal Mining Co.
R. L. KILLEBREW, Westinghouse Electric Corp.
A. E. LAMM, Sunnyhill Coal Co.
ARTHUR S. MACKE, Mid-Continent Coal Corp.
H. E. MAUCK, Olga Coal Co.
W. L. McMORRIS, Coal Div., U. S. Steel Corp.
L. O. MILLARD, Link-Belt Co.
M. D. MILLARD, American Steel & Wire Div.
W. D. MOREMAN, Sanford-Day Iron Works, Inc.
E. M. PACE, Inland Steel Co.
MOSS PATTERSON, West Kentucky Coal Co.
C. B. PECK, Anaconda Wire & Cable Co.
W. B. PETZOLD, The Hudson Coal Co.
ADRIAN W. RICH, Fairmont Machinery Co.
H. C. ROSE, Pittsburgh Coal Co.
S. F. SHERWOOD, Stonefort Corp.
M. A. SHOFFNER, Freebrook Corp.
H. H. SMITH, National Malleable & Steel Castings Co.
R. B. WARREN, Goodyear Tire & Rubber Co.
W. L. WEARLY, Joy Mfg. Co.
R. R. WILLIAMS, JR., Colorado Fuel & Iron Corp.
ROBERT E. YOUNG, Harnischfeger Corp.

NEWS

and VIEWS



Eastern and Central states



New Carbon Company

Pittsburgh Consolidation Coal Co. and Standard Oil Co. (Ohio) have jointly formed the Mountaineer Carbon Co. to operate a carbon calcining plant at Cresap, W. Va., on the Ohio River. The plant will have a yearly capacity of 165,000 tons of high-grade calcined carbon, used principally as electrodes that feed electricity in aluminum electro metallurgical and chemical production.

Plant construction has been started and initial operation is expected in January 1958.

Part of the raw material for the plant will be coke supplied by Pitt Consol; the rest will be petroleum coke supplied by Standard's Toledo and Lima, Ohio, refineries.

Pitt Consol is building, adjacent to the calcined carbon plant, a \$25,000,000 coal processing plant, which will turn out heavy coal liquids as well as coke for the carbon plant.

Officers of Mountaineer Carbon are Joseph Pursglove, Jr., president; R. C. Sauer, vice-president; H. S. Moller, Jr., secretary; and James F. Bisset, treasurer.

Education Committee Meets

The Vocational Training and Education Committee of National Coal Association met at the School of Mines and Metallurgy, Rolla, Mo., October 5 and 6, 1956. During the afternoon of the first day the heads of the various departments in the

Department of Mining discussed their respective curricula. On the second day, following further discussion of the mining curriculum, and a closer look into facilities for teaching mining subjects, the committee held an executive meeting. The next meeting of the group will be at Virginia Polytechnic Institute on May 3 and 4, 1957.

Nickel Mine Project

Arcadia Nickel Corp., Sudbury, Ont., Canada, plans a \$3,500,000 mining development 28 miles west of Sudbury. Arcadia will start production at the old North Denison Mine at Worthington, now called the Robinson mine, and on the shaft of a second mine, the Rosen, on the same property.

Work is scheduled to start next spring on a \$1,500,000 concentrator to be built between the two mines, and it is expected that shipments of nickel and copper concentrates will begin within a year.

The Arcadia property is near the International Nickel Company's Crean Hill Mine.

Proposed Uranium Plant

Kennecott Copper Corp., New York, and The Koppers Co., Pittsburgh, submitted on October 1 a proposal to the Atomic Energy Commission to process uranium for use in reactors. The proposal calls for the construction and operation of a feed-materials plant with a productive capacity of up to 5000 tons a year of uranium salts. Kennecott and Koppers each would furnish 50 percent of the capital.

New Titanium Sponge Plant

A new titanium sponge plant with an annual capacity of 10,000,000 lbs will be placed in operation by the end of next year by U. S. Industrial Chemicals Co., division of National Distillers. The plant will be located in Ashtabula, Ohio near USI's existing sodium and chlorine plant. Both these products will be used in production of the titanium sponge, in a new process developed by U. S. I.

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Graybar Bldg.	N. Y. 17, N. Y.
Colorado Bldg.	Denver 2, Colo.
Shoreham Bldg.	Wash. 5, D. C.

Peabody Debenture Sale

Peabody Coal Co. has filed a registration statement with the Securities & Exchange Commission covering the proposed sale of \$35,000,000 of sinking fund debentures, due 1976. This offering of new debentures, which will be underwritten by a group headed by The First Boston Corp., represents the largest financing to be made by a coal company in recent years.

A sinking fund is provided sufficient to retire \$1,950,000 of the debentures annually, commencing in 1959, and calculated to retire \$33,150,000 (about 95 percent) of the debentures prior to maturity.

Peabody, second largest commercial producer in the bituminous coal industry, plans to use approximately \$28,000,000 of the proceeds for the retirement of certain outstanding funded debt and to add the remainder to general funds.

Expenditures for property developments and additions, including acquisition of additional coal reserves, development of new mines and purchase or extension of transportation facilities, are expected to amount to about \$38,600,000 for the period 1956

through 1959. To the extent that additional funds are required to complete this program, the company believes they will be available from depreciation and depletion and retained earnings from future operations.

Most of Peabody's production, which amounted to approximately 8,825,245 tons produced by underground mining and 12,888,838 tons by strip-mining in the 12 months ended June 30, 1956, is sold to electric utility customers under long-term contracts.

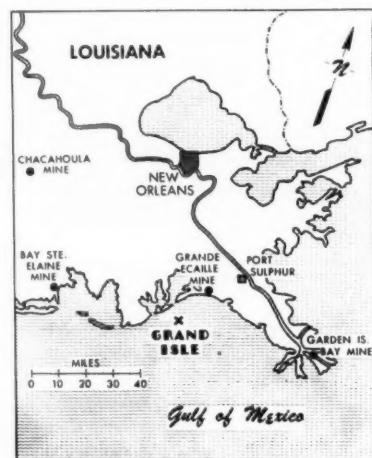
Research Site Purchased

Rem-Cru Titanium, Inc., Midland, Pa., has announced the purchase of 262 acres of land near the Ohio River about five miles northeast of the company's present production facilities in Midland. The company announced that the land is intended for possible future construction of a new research laboratory and administration offices.

Rem-Cru's present facilities include over 237,000 sq ft of factory space, engineering and research buildings, and a modern office building. The purchase of the new site is part of the company's over-all expansion program.

To Mine Sulphur

The first completely off-shore sulphur mining operation in history will be undertaken by Freeport Sulphur Co. at a deposit discovered in the Gulf of Mexico by Humble Oil & Refining Co. Officials of the two com-



Freeport Sulphur Company will build the first completely offshore sulphur mining plant in history at the Grand Isle deposit located off Louisiana in 45 ft of water six miles from the nearest land. Freeport now mines sulphur from four other coastal deposits: Grand Ecaille, Garden Island Bay, and Bay Ste. Elaine, all in the delta marshland, and Chacahoula, in the midst of a cypress swamp. The Bay Ste. Elaine mining plant was built on a barge and floated to the site, while the others were built on forests of pilings.

panies believe the deposit, located off Louisiana in 45 ft of water, six miles from the nearest land, represents a major new source of sulphur.

Under a contract signed by the two companies, Freeport will design, install and operate a mining plant to produce sulphur by the Frasch process. Construction is required to begin by the latter part of 1958 and is expected to take two years to complete.

The sulphur deposit, known as Grand Isle—Block 18, was found approximately 1700 ft below the floor of the Gulf in the caprock of a salt dome.

Although Grand Isle will be Freeport's first sulphur mining operation in offshore waters, the company has successfully operated sulphur mines in coastal marshes. Two of these plants were erected on pilings, and the third was built on a barge which was floated to the site and sunk in place.

Insulated barges will shuttle the Grand Isle sulphur in molten form to Port Sulphur, a storage and shipping point about 25 miles distant. On the return trip, the barges will haul fresh water necessary for boiler makeup and auxiliary services.

There's no question — about the importance of Roof Bolting today.

HUNDREDS of bolted mines—representing 62% of the 1955 underground coal production—improved their safety records and increased production from 10 to 20% per man resulting in lower labor costs.

Effective bolting calls for thorough knowledge of roof strata—well planned bolting patterns and cycles—proper selection of bolts and shells with an adequate supply and service program. PATTIN Mfg. Company, "The Pioneer In Roof Bolting" offers the most complete line of quality bolting products with an experienced engineering staff for consultation and service. Write or phone us today.

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New River Dock

A four million dollar terminal will be built on the Mississippi River at Port Sulphur, La., by the River & Gulf Transfer Co., and the West Kentucky Coal Co., for the transhipping of phosphates and coal between river and ocean-going barges.

Ocean-going barges with phosphates from Florida and river barges with coal from Kentucky mines on the Ohio River will meet at the new Port Sulphur terminal and exchange cargo. The coal will be delivered to an electric power plant at Tampa, Fla. The phosphates will be delivered to fertilizer plants in the Upper Mississippi, Illinois and Ohio Valleys. The terminal will provide two million tons of coal storage.

New Flotation Plant

Lawson Feldspar & Minerals Co. has started construction on the first unit of a modern flotation plant in Mitchell County, N. C. The plant is designed to recover feldspar and other minerals from alaskite ore and will have a capacity of 100,000 tons of feldspar concentrates a month.

New Alabama Coal Mine

DeBardeleben Coal Corp., Birmingham, Ala., has begun production at its Waterside Mine on the Warrior River to supply coal needs of the International Paper Company's newsprint mill at Mobile. It is estimated that the new mine, a strip-mining operation only 200 yd from the river's edge, will produce 250,000 tons of coal a year for the next 15 years.

Coal from the Waterside Mine, the second new mine opened by commercial coal operators of Alabama in many years, is being sold to International Paper at a price delivered at the user's plant site. The coal is not being sold by the ton, but only by contained British thermal units. Only water transportation will be used to move coal from mine to paper mill.

Turbine Gets Final Test

McGill University, Montreal, Canada, is completing final tests, prior to an international demonstration, of a model coal-powered turbine for use in locomotives and stationary engines.

The Canadian Government, hopeful that the turbine may help the coal industry, has financed experimental work with \$650,000. Prof. Donald L. Mordell, director of the project, has reported that, if the turbine is successful, it could save from \$20,000 to \$50,000 a year in fuel costs for a locomotive.

The turbine is of novel design in that it has a heat exchanger which feeds clean, hot compressed air into the turbine blades. The exchanger

prevents fly ash from going directly into the turbine and abrading or corroding the blades, a problem which has plagued attempts to develop coal turbines in other countries.

Prof. Mordell and his assistants think they have solved the problem of finding a metal or alloy that would resist corrosion during continuous and prolonged operation of the heat exchanger.

A demonstration of the model turbine is planned this fall at McGill's gas dynamics laboratory at Ste. Anne de Bellevue, near Montreal.

Asarco Gets Limonite Deposit

The American Smelting & Refining Co. has taken an option on the 1000 sq mile Lunga Concession, located northwest of Lusaka in Northern Rhodesia, from the New Discovery Mining Corp.

Asarco will explore the concession with particular reference to a large limonite deposit which is expected to require deep core drilling. New Discovery Mining Corp. has contracted to do the exploratory work on behalf of Asarco.

The DRILL to SEE!

Fletcher
ROOF CONTROL DRILLS

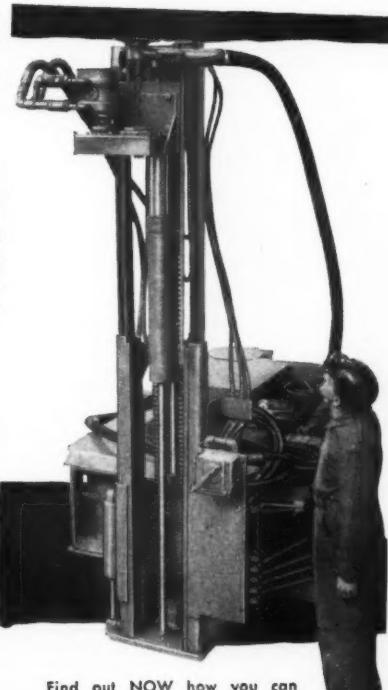
There's one in
use near you!

FLETCHER Roof Control Drills are operating in mines from New York to New Mexico, from Alabama to Wyoming, and in most of the states in between.

HUNDREDS of mine operators throughout the country have found FLETCHER Roof Control Drills superior for drilling harder rock and installing more bolts at lower cost.

So there's a good chance that you'll find a nearby mine using FLETCHER Drills. Ask to see them working! Talk with the crew and management! We believe that you will be convinced that a FLETCHER Roof Drill will do your job best and at lowest cost.

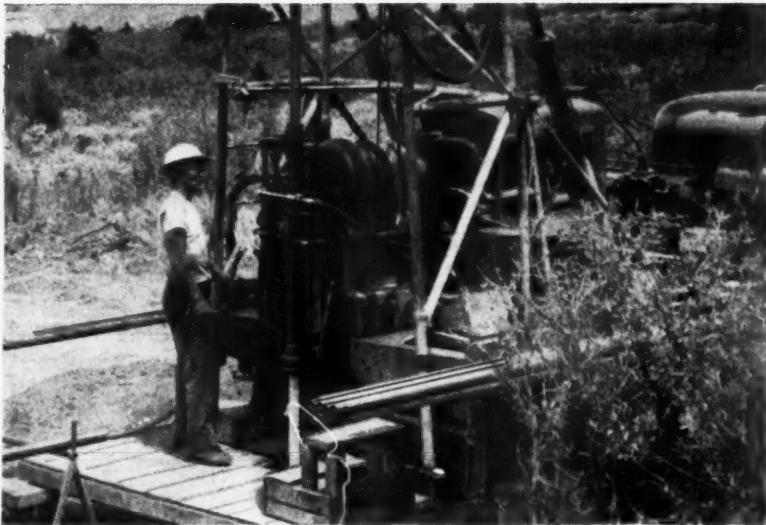
- Jack-feed system delivers maximum smooth thrust with quick raise and return.
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- Telescoping mast gives full stroke in varying seam conditions. And the new floor-to-roof mast gives added safety, speed and power.



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One of the many drill rigs now in operation throughout the United States and overseas.

The most important primary phase of construction, roadbuilding or mining begins with foundation investigation or exploratory work from which it is desired to get complete information and best possible cores. In many instances, contractors make the mistake of bidding on work or taking a contract without complete knowledge of sub-surface conditions, or miners will start mining operations without first conducting a thorough exploration program, but successful contractors and mining men always investigate first to know how to quote in order to get the contract and still make a profit, and how to plan to have a successful operation. One of the most reliable organizations in America for furnishing this information and satisfactory cores is Sprague & Henwood, Inc. For more than seventy years it has been rendering satisfactory core

drilling service throughout the United States and the world. Many of its customers have continuing contracts with Sprague & Henwood, Inc., because they know that they can be assured of the best in foundation investigation and core drilling service that can be found anywhere.

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Engineer Wanted

Mining Engineer required as a Mine Superintendent of an underground gypsum operation. Attractive surroundings and living conditions in the heart of New York State's Finger Lakes Region. Position is of a supervisory nature with a minor amount of engineering required. Mine is completely mechanized with most modern equipment available. Apply stating qualifications, experience, marital status, age, salary expected to THE RUBEROID CO., Caledonia, N. Y.

Pickands Mather Extends Canadian Activities

A lease agreement for a large body of iron ore in west-central Labrador (Newfoundland), estimated to contain at least 200,000,000 tons of concentrates through open-pit mining, has been obtained by Pickands Mather & Co., Cleveland, on behalf of themselves and The Steel Company of Canada, Ltd. The lease was granted by Canadian Javelin, Ltd., of Montreal, from whom Pickands Mather & Co. has agreed to purchase during the period of 1959 through 1964 up to 2,000,000 tons per year of iron ore pellets which Javelin is to produce from its property.

The lease, which has already been submitted to Newfoundland officials for final approval, covers a part of the five square mile "Wabush Lake" property which Javelin has under lease from the Province. It is approximately 200 miles north of Seven

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

OF THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October 1, 1956.

City of Washington.

District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared Robert W. Van Evera, who having been duly sworn according to law, deposes and says that he is the Editor of THE MINING CONGRESS JOURNAL, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in Section 537, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor and business manager are:

Name of publisher, The American Mining Congress, Washington, D. C.

Editor, Robert W. Van Evera, Washington, D. C.

Business Manager, P. D. McMurrer, Washington, D. C.

2. That the owners are: The American Mining Congress—a corporation not for profit. No stockholders. President, Howard I. Young, St. Louis, Mo.; Executive Vice-President and Secretary, Julian D. Conover, Washington, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

ROBERT W. VAN EVERA,
Editor.
Sworn to and subscribed before me this 15th day of October, 1956.

KATHRYN A. HATHAWAY,
Notary Public.
(My commission expires July 31, 1957.)

Islands. The ore is a low-grade, coarse-grained material which present tests indicate can be concentrated to high-grade iron ore.

The statement pointed out that Javelin's status as an independent company will not be affected. No investment by P. M. and Stelco in Javelin is involved.

Other phases of the agreement include:

P. M. and Stelco will have first refusal of certain parts of the Wabush Lake area in the event that Javelin should decide to dispose of or sublease all or any part of this area.

P. M. and Stelco will have the right to select and take under lease certain additional lands in the 4700 square mile area which Javelin has under concession from Newfoundland, and the right of first refusal on iron ore rights in the balance of the concession area.

P. M. will act as sales agents in the United States and Canada for iron ore produced by Javelin.

P. M. will be available for consultation to Javelin on mining and concentrating processes in its Wabush Lake holdings, and to work with Javelin to coordinate the development of their respective interests in the Labrador area. However, P. M. will have no responsibility for the construction or operation of the Javelin development at Wabush Lake.

In commenting on the transaction, John Sherwin, senior managing partner of Pickands Mather, said, "This is a fine opportunity to extend our iron ore mining activities in Canada. The cooperation we have received in the development of The Hilton Mines in Quebec has been most encouraging.

"We have not yet made the detailed studies of the property which must precede actual mining activity, and so we are not able to set a date for the beginning of development operations."

Armco Dissolves Subsidiary

The Princess Dorothy Coal Co. of Twilight, W. Va., has been dissolved as a wholly-owned subsidiary of Armco Steel Corp. and is now being operated under Armco management. The property, acquired in 1954, is now known as the Robin Hood Mine of Armco Steel Corp. C. O. Kane, manager of mines, with offices at Montcoal, W. Va., will head the operation of Robin Hood along with the No. 1 and No. 7 mines at Montcoal.

James Trusley, formerly superintendent of the Nellis Mine, has been appointed superintendent of the Robin Hood Mine with headquarters at Twilight. Elvin Miller, former industrial engineer at Montcoal, has been named assistant to the superintendent at Robin Hood. Green Clendenin, who has been on temporary assignment at Robin Hood, has been named general foreman of No. 7 Mine at Montcoal.

American Mining Congress

Annual Meeting

LEWIS W. DOUGLAS, former Ambassador to Great Britain and former Director of the Budget, will be the guest speaker at the Annual Membership Meeting and dinner of the American Mining Congress, to be held on Monday evening, December 3, in the Terrace Room, Hotel Plaza, Fifth Avenue at 59th St., New York, N. Y.

A short business meeting, for submission of reports on the year's work and election of directors to succeed those whose terms expire, will precede Douglas' address.

The dinner meeting will follow a reception—dress informal—at 6:00 P. M. All members of the American Mining Congress are cordially invited and urged to attend.

The AMC Land and Water Use Committees will meet jointly with the same committees of the National Coal Association at noon on December 3. The AMC Tax Committee will hold an all day session on Tuesday, December 4, to consider various provisions in the Internal Revenue Code and Regulations which are of special interest to the mining industry. Accountants and others handling tax matters for member companies are invited. All meetings will be held in the Plaza Hotel.



Lewis W. Douglas

Pocahontas Buys Peerless

Pocahontas Fuel Co., the nation's seventh largest coal producer, has acquired a controlling interest in Peerless Coal & Coke Co. of Bluefield, W. Va.

Roland C. Luther, president of Peerless Coal & Coke, disclosed that "practically all" of his company's stock was transferred to Pocahontas Fuel in a stock exchange transaction.

Pocahontas Fuel is the nation's largest commercial producer of low-volatile bituminous coal, with an output last year of over 8,000,000 tons. Low-volatile coal is used by the steel industry to produce high-quality coke for blast furnaces, and Pocahontas Fuel's domestic sales are largely to metallurgical and electric utility industries. Its principal mines are in southern West Virginia and southwestern Virginia.

With acquisition of Peerless Coal & Coke properties near Vivian in McDowell County, Pocahontas Fuel acquires additional reserves and production capacity in the Pocahontas coal seams. Pocahontas Fuel already operates seven mines, producing coal from the Pocahontas No. 3, 6, 10 and 11 seams, and also has a controlling interest in the three mines operated by American Coal Co. of Allegany County, whose operations are in the Pocahontas No. 3 and 6 seams.

Peerless operates its No. 4 mine at Vivian, producing about 4000 tons of coal a day from the Pocahontas No. 3 and 4 seams averaging 42 and 72 in.

thick. The mine has a life expectancy of about 50 years.

A. V. Sproles, vice-president in charge of operations for Pocahontas Fuel, said there "will be no change in the operation of the Peerless company at this time."

Pocahontas Fuel itself is looking toward a possible merger with the mammoth Pittsburgh Consolidation Coal Co.

Expand New Cement Plant

Consolidated Cement Corp., Chicago, which started shipments earlier this fall from its new Paulding, Ohio plant, has already undertaken expansion of the installation's capacity. The additional manufacturing facilities will raise the plant's rated capacity to 2,500,000 bbl a year, double the recently completed plant's present capacity.

Dual Fuel System

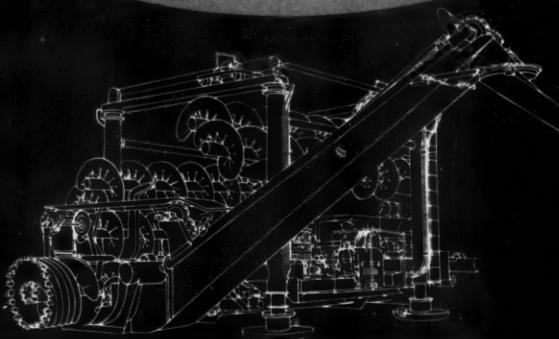
A new "dual fuel" system for diesel locomotives has been developed in the test laboratories of the Chesapeake and Ohio Railway at Huntington, W. Va.

The new system, which is expected to result in considerable savings in C&O's diesel operations, provides a method by which a heavy, lower-cost diesel fuel is put in use after the engine has reached normal operating temperatures.

The switch from normal, high-grade fuel is made when the throttle of the locomotive is advanced from the fourth

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the Better AUGER**

**COMPTON COAL
AUGER INCREASES
RECOVERY from
35% to 65%**



On operation after operation the Compton Coal Auger has shown its ability to increase coal recovery from 35% to 65%. In planned mining where all types of mining, auger, strip and deep, are used the Compton Auger has added greatly to the profitable efficiency of the overall operation—recovering quickly and profitably tons of coal which would be impractical cost-wise to mine by any other method.

Better RECOVERY with the Better AUGER:

Compton's patented non-clogging lump recovery head, which has been copied but never duplicated, cuts coal at high speed giving maximum recovery in record time... under favorable conditions as much as 870 tons in a 7 1/4 hour shift with a 4 man crew.

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Developed by the maker originally for his own use the Compton Auger is the successful result of much engineering research plus exhaustive field tests and actual on the job experience. Painstaking effort which reflects in the many Compton Augers now in use profitably recovering tons of coal for their satisfied owners.

For the complete Compton Auger facts and their correct application to your property, call for a Compton sales engineer now. Learn about planned auger mining from the pioneers in this rapidly growing field of mining "lost" coal at a profit.

Compton, Inc.
ORIGINATORS OF COMPTON LUMP RECOVERY HEADS

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to the fifth notch. At higher operating speeds, the heavy, cheaper fuel takes over and when the speed is dropped back again, an automatic changeover takes place and the regular distillate fuel is used again.

The heavy residual fuel will not idle a diesel without "souping," which occurs when the engine does not completely burn fuel causing oil to run down outside the stack and build up carbon in the engine. Under heavy load, this carbon would be blown out the stack in the form of burning particles and could create a dangerous fire hazard.

Although not usable at low temperatures, the heavy fuel contains more Btu's per lb and therefore produces relatively more horsepower than its higher-priced distillate counterpart.

Old Copper Mine Reactivated

Appalachian Sulphides, Inc., a new subsidiary of Nipissing Mines Co. Ltd., of Toronto, Canada, is reactivating a century-old copper mine known as the Ore Knob near Jefferson, N. C.

Plant construction above ground is nearing its final stages and the shaft has been completed at a total depth of 1037 ft; mine development is now under way. The mine is expected to be back into production next spring with a yield of 350 tons of ore daily.

The mine was first worked in 1856, and during the decade 1873-1883 it produced 25,000,000 lbs of copper.

The mine was closed down in 1883 when workings had reached a depth of nearly 400 ft and the operation had become unprofitable. Several unsuccessful attempts were made to reopen the mine between 1883 and World War I.

Nipissing Mines secured an option to purchase the mine in 1953, and, under the direction of Philip Eckman, present manager of the mine, diamond core drilling was undertaken in 1954. This exploration determined and located the depth extension of the ore beneath the old workings.

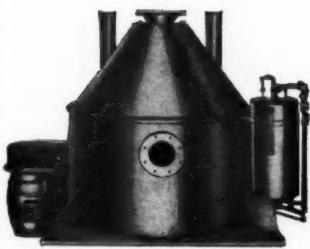
Will Build Nickel Refinery

Eastern Mining and Smelting Corp. will build a nickel refinery and power plant at Chiboutimi, Quebec, 110 miles north of Quebec City.

The refinery will produce approximately 300 tons of pig metal a day in addition to several hundred tons of sulphuric acid.

The ore will be brought to Chiboutimi from nickel mines in the new community of Chibougamau, about 200 miles northwest of the refinery, from Gordon Lake, Ont., and perhaps from Haiti.

Rotating oil-fired kilns will be used to separate the metal from the ore, which will reach the refinery by truck, rail and ship.



FOR DRYING COAL THE ECONOMICAL WAY

... your best buy is C-M-I. Through 40 years of experience, C-M-I has developed a dryer that provides an actual saving of 24% in horsepower over other comparable units. This new, improved centrifugal dryer offers you smoother, more dependable performance in addition to drastically reduced operating and maintenance costs.

If you are searching for an economical answer to that expensive heat-drying problem, write C-M-I for particulars.



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Reap additional profits with efficient slurry recovery.



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INDUSTRIES, INC.

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August Coal Mine Fatalities

Coal mine accidents during August caused 30 deaths but the fatality rate was the lowest for any month this year, the U. S. Bureau of Mines announced. The Bureau said the August death rate was 0.63 per million tons of production and 0.80 per million man-hours of work time.

Through August 31 there were 306 coal mine fatalities, compared with 294 in the similar period last year. However, with increased production this year, the fatality rate was 0.88 per million tons compared with 0.93 a year ago. The rate per million man-hours worked was the same each year, 1.13.

Clean Canadian Coal

Dominion Coal Co., a subsidiary of Dominion Steel & Coal Co., plans a new coal washing plant at Grand Lake, Nova Scotia, to handle coal from company mines in the New Waterford-Glace Bay area, locale of Nova Scotia's heaviest coal production.

It is understood the plant will be larger than the \$1,000,000 unit recently installed by Old Sydney Collieries, Ltd., at Sydney Mines.

Engineer—Graduate

Excellent opportunity for qualified individual to handle sole of mining equipment. Desire man experienced dealing with top management. Age 30-40 years. Travel required. Established company. Replies confidential. Address all replies to Personnel Manager, Robins Conveyors Division, HEWITT-ROBINS INCORPORATED, 270 Passaic Avenue, Passaic, New Jersey.

Pennsylvania Coal Research

The recently created Pennsylvania Coal Research Board has been deluged by coal research proposals ranging from cheaper ways to crush anthracite into small sizes to an easier method of removing sulphur from coking coal. The board is supervising expenditure of \$500,000 appropriated by the legislature for improvement of anthracite and bituminous coal markets.

Other research proposals in the hands of the board include seeking ways to:

Remove a tendency in bituminous coal to cake into a mass of partly burned fuel in the furnace and thus impede the passage of air through the

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with...

Greensburg
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battery
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5 TON HIGH TYPE MONITOR

Available in 3 to 12 tons: 42 to 48" high, 18 to 56½" track gauges.

Greensburg's dependable performance results in operating economy. Advanced engineering design and custom-building to specifications give Greensburg Locomotives up to 20% more efficiency and longer battery life than any other storage battery locomotive of equal weight and battery capacity. More earning power per dollar invested!

Built in single or double motor drives with double equalizers, drum or contactor type controllers, with or without dynamic braking, Greensburg Locomotives will haul more and cost less to operate!

Send us your haulage problem today!

GREENSBURG MACHINE CO.

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Greensburg, Pa.

bed, retard combustion and prevent difficulties in resuming operations after banking.

Discover better solvents to break down soft coal into other products such as carbon electrodes that could be used in compounding rubber or into a raw material that can be used for making pipe enamel.

Blend anthracite with bituminous coal in making coke used for steel.

Improve market studies for both anthracite and bituminous coal.

Control water contamination in the bituminous coal fields.

Produce active carbon from anthracite and use anthracite for making carbon and graphite electrodes.

Mineral Associations Merge

The Mineral Producers Association of Kittanning and the Independent Coal Producers Association of Butler, Pa., have been merged into the Independent Mineral Producers Association, with offices in the Mellon Bank Bldg., Butler.

Officers of the new association are William C. Altvater, president; William L. Harger, vice-president; Franklin H. Mohney, executive vice-president; and J. P. Macfarlane, secretary-treasurer.

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MICHIGAN CHEMICAL CORPORATION
Rare Earths Division, Saint Louis, Michigan

Titanium Contract

Horizons, Inc., a Cleveland, Ohio, research and development company, has been awarded a \$200,000 development contract by the Navy Bureau of Aeronautics. The contract covers development of a commercial method for producing titanium electrolytically.

Horizons officials claim they have developed in the laboratory a process for producing titanium "at signifi-

cantly less cost than the present Kroll process." According to Dr. Eugene Wainer, vice-president and director of research, the new process has been in the experimental stage for the past two years and now has been successfully proven by Horizons in the laboratory. The new process produces titanium in the form of coarse granules, differing from the sponge now being produced. The process is a modification of the original fused salt electrolysis procedure.

Increase Dragline Efficiency with Bucyrus-Erie All-New Dragline Buckets

New concepts in design plus a special new lightweight alloy in Bucyrus-Erie dragline buckets offer you new efficiency in dragline operation. Look at these outstanding advantages:

Easy Loading — A "slicing-action" lip rapidly penetrates even tough materials, and scientifically tapered basket permits full, heaped loads.

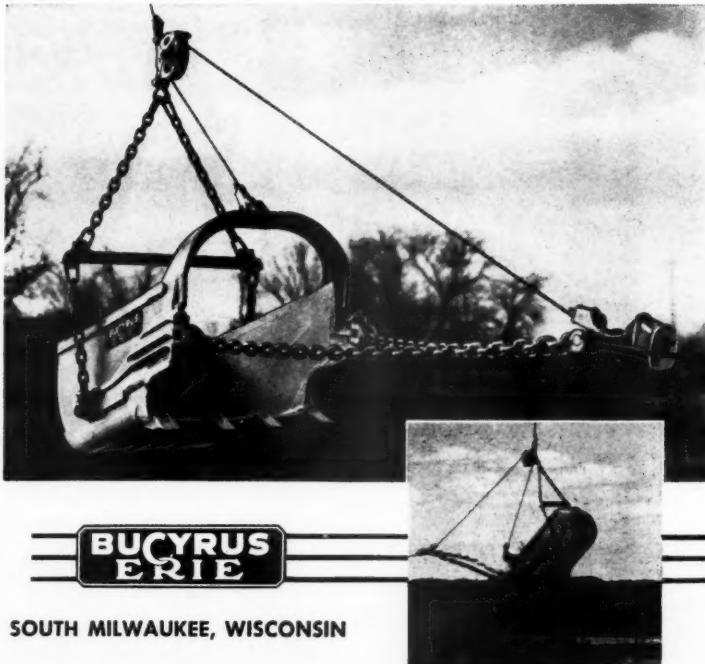
Less Bobbing, Spillage — Proper design incorporates correct flaring and balance of the bucket for clean carrying.

Fast Dumping — Smooth interior design and high arch permits quick, clean dumps.

Exclusive BECOLOY — A new special alloy developed by Bucyrus-Erie combines great strength with light weight, adds wearing ability and impact resistance.

New Bucyrus-Erie dragline buckets are available in three types: light, medium and heavy duty — solid or perforated. Your Bucyrus-Erie distributor has the experience to help select the right size and type for your operations. See him soon.

21856



**BUCYRUS
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Gunnar Uranium Deposit

(Continued from page 72)

blockages. At our request, Imperial Oil Ltd. has developed and supplied Arox E.P. 38, with a pour point of minus 50°F, and this is giving much better satisfaction. We use a graphite compounded grease, Van Arctic No. 2, for dipper handles, slides and other outside grease-lubricated points on the shovel units. We have found that the use of X.P. Compound Arctic Gear oil instead of the conventional grease has been much more satisfactory on the shovel and crane hook rollers below minus 30°. Naturally the diesel fuel for all outside equipment is of premium grade and this is Esso P-40 with a pour point of minus 55°F.

Equipment Modifications

We must keep portable compressors close to the drills during cold weather operations to eliminate airline freezing. This arrangement has been incorporated into the design of the I-R Drillmaster drills, and we have also installed flexible ducts to direct some of the engine heat to the drill operator's cab. During short shutdown periods engines are kept running and the rotary heads are left in gear at slow speed to prevent blockage of the lubricating and hydraulic lines. Modifications are being made to these rotary head controls by installing sealed hydraulic pilot controls with a variable bypass valve on the thermal governor control units so that rotation speed can be adjusted during cold weather starting. During weekend and long shutdowns all diesel engines are kept at a satisfactory starting temperature by Universal "Early Bird" Engine Heaters, Model DG-28.

The 36TD Euclid trucks are fitted with dump boxes which are heated by the engine exhausts. The cabs are equipped with Kaysor hot water heaters of a re-circulating type with variable speed motors and windshield defrosters. The engines have been fitted with Cummins-Switzer fans which are thermostatically controlled. All truck engines are equipped with air starting motors. The trucks are stored in the garage when not in operation and since this garage is constructed with radiant heating in the floor, all units are soon relieved of accumulated snow and ice. These truck units have required very few field modifications, and their cold weather operation has been very satisfactory.

Our Marion shovel units were supplied with booms fabricated from Tri-Ten steel, which has a critical low temperature range of minus 15° to minus 40°F. An unsatisfactory bumping block arrangement at the base

of the boom did not prevent the bucket from striking the boom and this initiated cracks which extended into the boom side members. This necessitated frequent welding repairs. While operating at 42° below zero one boom fractured midway between the heel and the shipper shaft in an almost total and clean break. This was repaired by removal of the stressed metal and replacement with sections of "T" steel using an AWS-8016 electrode containing 2½ percent nickel. This rod has been found to give very satisfactory service for repairing equipment subject to low temperature conditions, and none of these repairs need be stress relieved. Tooth breakage in the main rotating gears has also been a serious problem during winter operation. Our revised specifications, worked out in conjunction with the manufacturer, require all dipper handles, booms, main rotating gears and steering lock shifters to be fabricated from "T" steel. It has been necessary to cut these new main rotating gears from a solid slab of "T" steel 96 in. sq by 6 in. thick. This "T" steel, which is manufactured by the United States Steel Corp., has superior mechanical properties and it is claimed to have the ability to withstand impact abuse at temperatures much below that of the steel alloys heretofore developed.

We have found that if a machine stands idle in extremely low temperatures for any length of time, the plastic composition seal presently being supplied with modern equipment fails, since it will adhere to the rotating shaft and be ruptured when this shaft is turned or started. Leather gives more satisfactory service where it can be substituted, but it is not the final answer. We are still searching for a good all-weather seal. Any standard type of rubber hose assumes the characteristics of a glass rod at low temperatures, and all hoses have been replaced with "Aeroquip," Type 1503, which is a single wire braid hydraulic hose. We have used this type of hose on the dipper trip controls which are being continually wound and unwound and it has given very satisfactory service. The standard type of alcohol dispenser supplied with the shovel units has been satisfactory, and we use approximately one quart of alcohol per machine per shift during the cold weather. Air cylinder parts, especially the air piston cup leathers, are being changed to a new sub-zero type.

Storage batteries are a continual source of trouble in cold weather, and our shovel engines are now being equipped with air starters. We have also found that batteries have a very short life on any portable equipment which tends to vibrate since there appears to be an early breakdown of the cells. All Caterpillar units are equipped with standard gasoline en-

gine starting systems, and these have given excellent service. The supply of light on the shovel units is important since there are 16 hours of darkness per day during the winter months. The use of standard gasoline auxiliary engines and generators has proved to be very costly, and downtime has been excessive despite the fact we have kept complete spare units on hand for quick replacement. We are presently installing three-kw Thyrite controlled d-c generators driven by a power takeoff from the main engine which will eliminate the need for auxiliary engine generator sets, and supply a constant voltage with a varying speed prime mover. It is important to provide plenty of protection for equipment operators since their efficiency drops very rapidly in extremely cold weather. Ample protection has been given by the insulation of the floor and lower section of cabs, installation of heaters where necessary and the application of canvas side shields to equipment so that engine heat can be directed to the operator.

Conclusion

The arrival of the first construction crews on the site on July 1, 1953, initiated a drive to place the property on a producing basis as soon as possible. That goal was achieved 26 months later. We anticipate that our current expansion program will be completed by the end of this year. I wish to express my thanks to Mr. G. A. LaBine, president of Gunnar Mines Ltd., to Mr. James Houston, former general manager, and to the directors and consultants for their generous support. I also wish to record with great appreciation the excellent cooperation and assistance given by the mine staff in completing these plans.

MANUAL ON ROCK BLASTING.
Atlas Copco Eastern, Inc., Patterson, N. J. or Atlas Copco Pacific, Inc., San Carlos, Calif. \$3.00

PUBLICATION of the third regular supplement to this internationally known manual on rock blasting has been announced. The new supplement to the two-volume manual contains latest engineering and technical reports on a calculation of charges with both bench blasting and stoping, location and design of permanent compressor plants, and a review of tungsten carbide bit development and utilization in percussion drilling.

Prepared in loose-leaf form in English, French, Swedish and German, the manual was originally published in 1952 as an international handbook for mining, tunneling, quarrying and construction engineers. The original manual is available at a cost of \$25.50.



Western States

Ransom Managed by Sunshine

Sunshine Mining Co. has taken over management of the 160-claim Ransom uranium property near Blanding, Utah, according to Robert M. Hardy, Jr., president. The Idaho silver producer has joined with Silver Syndicate, Inc., Sunshine Consolidated, Inc., and Clayton Silver Mines in purchasing 83 percent interest in the King Edward and King James claims, and in an operating agreement on the other 158 claims. Sunshine and the Clayton-Syndicate-Sun Corp exploration combine previously had acquired two-thirds of the other 20 percent interest in the King Edward and King James claims, which have yielded the principal production to date. The remaining one-third is held by Uranium Discovery & Development Co. of Wallace, Idaho.

Wyoming Iron Ore

Columbia-Geneva Steel Co. of Provo, Utah, has made its first 100-ton test shipment of iron ore from its claims south of Lander, Wyo., and has stockpiled another 100 tons. Half of the shipment went to the Geneva mill at Provo, and the other half to Duluth, Minn., where extensive test runs will be made. Several hundred samples of the iron ore were collected in the area this summer and tested at Duluth.

Colorado Coal Contract

L. M. Cooley, managing partner of the Edna Coal Co. of Denver, Colo., has announced that Edna Coal has signed a \$6,000,000 contract to supply a planned new power plant of the Colorado-Ute Electric Association at Nucla, Colo.

Cooley said the contract involves opening an entirely new coal mining operation near Nucla to provide the approximately 1,400,000 tons of coal to the REA Co-Op through 1972. "Nucla was designated as a site for the mine after geologists studied the entire area and uncovered new fields there of very high grade bituminous coal," Cooley said. "Much of it can be recovered through strip mining."

The rapid growth of uranium mining and processing, and population

has created a power shortage in the Four Corners area. Four co-ops with headquarters at Cortez, Durango, Montrose and Nucla combined as the Colorado-Ute Electric Association for the purpose of building a major power plant. A \$10,000,000 loan for the purpose has been approved by the Rural Electrification Administration and bids were recently opened for electric generators. Completion of the plant is scheduled for early 1958.

Homestake Mill Partnership

Homestake Mining Co. has announced it has entered into a limited partnership agreement under which it will undertake to complete negotiations with the Atomic Energy Commission for a uranium mill construction contract in western New Mexico.

The mill would be capable of handling 750 tons a day. Donald H. McLaughlin, Homestake president, said the partners have an option on ground for the mill in the general vicinity of Grants, N. Mex.

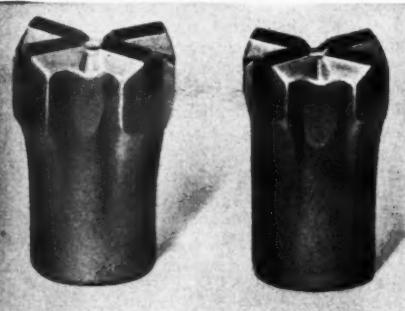
This would be the first expansion of Homestake, operator of America's largest active gold mine, into uranium milling. Homestake now mines uranium in Utah.

Ores for the mill would be supplied from a property contributed to the partnership by the United Western Minerals Co., J. H. Whitney & Co., and White, Weld & Co. and other interests. Homestake would also develop and operate a mine in conjunction with the partnership agreement.

Copper Cakes

Kennecott Utah Copper Division refinery at Garfield, Utah, is now casting 3200-lb copper cakes on its new vertical casting wheel. These are the largest finished copper shapes ever cast in Utah. The new casting wheel has been producing 2000-lb cakes and billets since it was placed in regular production this spring. It is expected that cakes weighing up to 4000 lb will be cast in the future. The 3200-lb cake is 25-in. wide, 57½-in. long and 7-in. thick. The cakes are the shape from which copper sheet is rolled.

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Brunner & Lay "400" carbide Rok-Bits—gauge sizes: 1½"; 2"; 2½" and 2¼"—"X" design body.

LONGER BIT LIFE—Rok-Bits' "X" design eliminates rifling—ensures a constant gauge hole—a ROUND hole to load.

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Bits work on new, uncut face; not in their own cuttings.

NO ADAPTER TO BUY—these Rok-Bits fit directly on G-D threaded steel.

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150 Leslie St., Dallas, Texas Sweeten Creek Rd., Asheville, N.C. 660 N. Tillamook St., Portland 12, Ore.
Birmingham Rock-Bit Co., Inc., 5-18th St., S.W., Birmingham, Ala.

Texas-Zinc Acquisition

F. A. Sitton, president of White Canyon Mining Co., has confirmed the sale of operating control of the company to Texas-Zinc Minerals Corp., a joint affiliate of the Texas Co. and New Jersey Zinc Co. Texas-Zinc is also constructing a multi-million-dollar uranium mill at Mexican Hat, San Juan County, Utah.

Armco Coal Mine in Oklahoma

Armco Steel Corp. has announced that it is seeking to open a coal mine near McAlester, Okla. In early October, Armco asked the Government for a certificate of necessity covering tax writeoff on a \$118,000,000 expansion project to increase the company's output of steel at its Houston, Tex., plant, operated by its Sheffield Division. A separate certificate of necessity was asked on \$5,000,000 for the opening of a new coal mine at McAlester.

Construction of the mine depends upon formal approval of the tax writeoff by the Government. Armco officials said they are ready to start construction of the coal mine early in 1957 if the certificate of necessity is granted.

It is estimated that the mine will employ 200 persons when in operation and will produce a maximum of 3500 tons of coal per day, depending on demand. The seam of coal, about four ft thick, lies under 1000 ft of overburden. As yet Armco has not decided whether to tap the coal seam by a 1000-ft shaft or by a long belt slope. Present thinking, however, is that a slope will be put down and that the mine will use a belt haulage system.

A coal preparation plant will also be constructed with the probability now being that coarse coal will be cleaned by jigs and fine coal on tables.

The Sheffield Division of Armco Steel Corp. now gets its coal from outside sources in Alabama and Oklahoma. Should the new mine be opened up, it would replace the present source of supply. The rail haul from McAlester to Houston, Tex., is approximately 500 miles and can be made on one carrier.

Lost Creek Uranium Mill

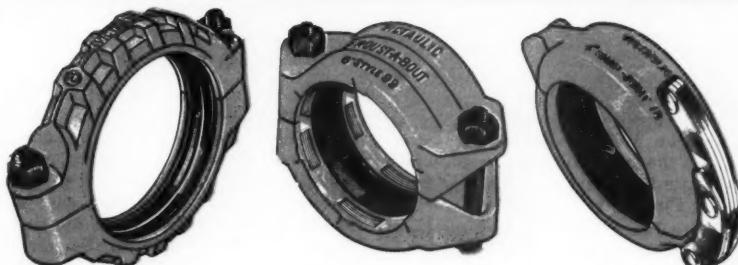
Lost Creek Oil & Uranium Co., Rawlins, Wyo., has signed a contract for the construction and operation of a uranium processing mill near Split Rock, about 56 miles north of Rawlins. Construction of the new plant is expected to start immediately with completion scheduled in about 12 months.

The mill will treat uranium ores in the Gas Hills-Crooks Gap area of the Wind River district in Fremont County. It will use an acid-RIP based on tests by the Colorado School of Mines Research Foundation, Inc.

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Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes $\frac{3}{4}$ " to 60".

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Chrome Mining Equipment

A \$223,000 purchase of metals processing equipment in Mesquite, Nev., has been announced by C. G. Cafarelli, president of both Comstock Uranium and Tungsten Co. and Chrome Inc.—Nevada corporations. Cafarelli said the equipment—a 300-ton mill, shop, laboratory and other mining facilities—is to be moved to the Chrome Queen Mine in Yreka, Calif., where the company hopes to produce 300 tons of ore daily.

Sabre-Pinon Defers

Agreement between American Metal Co., Ltd., and Sabre-Pinon Corp. on a multi-million-dollar mine and uranium mill development in the Ambrosia Lake area of New Mexico has been deferred.

Postponement of the annual stockholders' meeting of Sabre-Pinon Corp. to September 28 prevented action on American Metal's request for extension of the mine-mill agreement, which involved American's purchase of Sabre-Pinon stock.

Sabre-Pinon said: "An adjournment of the meeting without action on extending the agreement was recommended by Sabre-Pinon directors because 24 hours prior to the meeting American Metal requested what could amount to an indefinite extension of the agreement to ascertain whether or not there was an unusual water problem in the Sabre-Pinon ores in the Ambrosia Lake area.

"Management of Sabre-Pinon, based on present information, feels that while there is water present on the property, it is not an obstacle of consequence. In the event American Metal does not consummate the agreement prior to October 1, 1956, it will expire and Sabre-Pinon will proceed immediately to open negotiations with other corporations which have expressed an interest in the development of the properties and the erection of a mill."

Utah Construction Acquisition

Utah Construction Co. has exercised its option to acquire 60 percent control of Lucky Mc Uranium Corp., and thus set into motion a \$10,000,000 financing plan for a uranium mill in the Gas Hills District of Fremont County, Wyo. W. H. H. Cranmer, president of Lucky Mc, said that U-C would receive 3,638,748 shares of outstanding total stock in Lucky Mc, thus increasing shares outstanding to 6,064,580.

Under an original contract signed between U-C and Lucky Mc, the construction firm would establish ore reserves in the district on Lucky Mc claims; negotiate the mill contract with the Atomic Energy Commission; and finance and build the mill. U-C

has already received a "letter of intent" in regard to the mill from AEC, which will be used in securing bank loans. Cranmer said U-C has so far developed reserves of at least 1,000,000 tons of ore.

Vitro Dragline

A 200-ton dragline, with a six-yd bucket is being set up by Vitro Minerals Corp. at its Gas Hills uranium mine in Fremont County, Wyo. The large diesel-electric machine was shipped to Wyoming from a Pennsylvania coal operation on seven railroad cars. The new dragline will go to a depth of 140 ft, and is reported to be the largest piece of machinery used in uranium ore mining in the Gas Hills area.

Potash Safety Awards

Fifteen employees of Potash Company of America have been honored by Federal, State and company officials for outstanding achievement in the field of safety. Fourteen of the men received 20-year pins and one was awarded a 30-year token of appreciation. All had worked in the mining industry for at least 20 years without losing a day's time on account of an on-the-job injury.

New Park Resumes Operations

New Park Mining Co. has resumed operations at Park City, Utah, on a reduced basis, W. H. H. Cranmer, president, has announced. Some 175 miners reported for work on the first shift, in contrast to 290 employed when the mine was shut down September 1. Cranmer said that it is the aim of the company to develop new areas of copper production at the mine.

Northern Pacific Minerals

Northern Pacific Railway Co. has announced that it will enlarge its staff of geologists in order to initiate an aggressive policy of mineral exploration and development on its extensive land holdings. "The primary objective of the expanded company program is to provide basic information on the geology and mineral resources of areas of Northern Pacific ownership," explained P. D. Edgell, general manager of properties and industrial development. Edgell also said that the expansion of the geologic staff will expedite the processing of applications from mining companies and individuals for prospecting permits and mining leases on Northern Pacific lands.

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Spray container eliminates wasted surplus and time in application. Cannot leak or spill.

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Case of Twelve—12 ounce Cans... \$17.40

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SPECIALISTS IN FINE PENETRATING OIL FOR OVER THIRTY YEARS

Federal Nevada Operations

Federal Uranium Corp. has entered into an agreement to become the operator of two mining properties in Nevada, according to Ralph W. Neyman, president.

The properties are the Galena Hill mine, a lead-silver operation 11 miles south of Reno, and the Rabbit Hole placer, a gold property 57 miles north of Lovelock. Federal will receive 50 percent of the net profits after first recovering the costs of fully developing the mines, Neyman said.

The agreement was made with Constant Minerals Separation Process, Inc., of Reno, who controls both properties. In the operating agreement, Federal agreed to loan Constant Minerals \$100,000 repayable out of production.

Cordero Curtails Exploration

Cordero Mining Co., one of the largest quicksilver producers in the United States, has discontinued exploration work at the Mt. Diablo Mine and the Reed Mine in California, and their G&R prospect near Battle Mountain in Nevada.

The only quicksilver exploration or development work in which they are now engaged is with the current operation at the Cordero Mine and the cleanup operation at Horse Heaven Mine in Oregon.

Anaconda Solves Problem

The Anaconda Co. has announced that after nearly two years of laboratory and test plant work it has solved the problem of producing alumina from clay located in the area of Moscow, Idaho. Company spokesmen stated that the alumina thus produced has been in substantial quantities and within the specifications required by it under its contracts for this material extracted from bauxite. Alumina is the substance from which aluminum is made. Heretofore it has been extracted from bauxite, of which the principal sources of supply for the United States are the islands of the Caribbean. It has been known that alumina is also contained in commercial quantities in some of the clays of the United States.

Attempts had been made without success by the United States Bureau of Mines and other agencies for more than 25 years, to solve the problem of extracting alumina from these domestic clays. The matter became particularly acute during the submarine campaign of World War II, and extensive work was done at that time as well as during the period of World War I in an attempt to free the United States from its dependence upon overseas sources of supply. It was not, however, until May of this

year that a test plant that had been constructed by Anaconda in connection with its laboratories at Anaconda, Mont., was finally successful in producing a commercial grade of alumina. Now, the company is in the process of designing and constructing a pilot plant of 50 tons per day capacity, from which it is expected a full-scale commercial plant will be developed with adequate capacity to furnish the company's total requirements for alumina on an economically competitive basis. It is anticipated

that the design and construction of the pilot plant will require approximately one year, at a cost of slightly over one million dollars.

In anticipation of the success of its project, the company has already optioned vast reserves of clay in the Moscow, Idaho area, which is within approximately 375 miles by railroad of its Montana aluminum plant. It is expected that when it is constructed the commercial plant will be located at the site of the clay deposits.



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Profitable for Cleaning All Kinds of Fine Coal

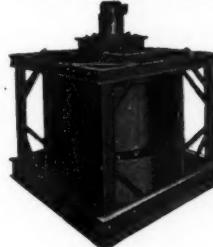
The SuperDuty® DIAGONAL-DECK® Coal Washing Table is made in two models for the cleaning of different types of coal feeds.

For high refuse feeds, the Model HCRD table provides extra discharge capacity for efficiently meeting abnormal refuse conditions.

For the more usual feeds of lower refuse content, the standard SuperDuty Table is used.

Either model delivers exceptionally clean washed coal while recovering more coal from the feed than is possible with any other fine coal washing process.

For detailed information, write for Bulletin 119.



CONCENCO Feed Distributor

While unexcelled for feeding coal washing tables, the CONCENCO Revolving Feed Distributor also effectively provides a splitting of feed into any desired number of equal portions, to accurately feed any circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all steel machine with motor drive requiring 1 H.P. or less in operation.

THE DEISTER® CONCENTRATOR COMPANY

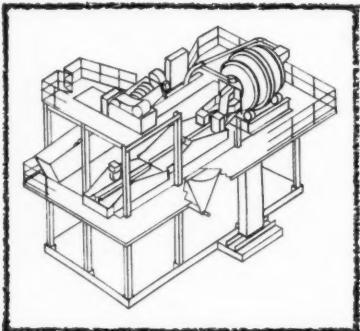


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and in major countries
throughout the world.

Montana Output

Montana's mineral production reached a new all-time high of \$167,700,000 in 1955, according to the U. S. Bureau of Mines, which represented an increase of nearly \$42,000,000 over the preceding year.

Metals comprised about 63 percent of the State total, with copper production of \$60,800,000 accounting for slightly more than half of the metallic portion. Zinc ranked second in value with a total of \$16,900,000.

Fluid Mining of Trona

Intermountain Chemical Corp. has started fluid mining of selected trona area near Westvaco, Wyo. Resident manager C. A. Romano said that the soda ash brine is now being pumped from wells sunk 1600 ft into the vast trona beds of the region.

The mineral is dissolved by a hot water "solvent" placed into one well under pressure and allowed to percolate through the trona rock. The brine then is removed a few hundred feet away through another well. The fluid then is piped into the reduction plant at Westvaco where the soda ash will be recovered. Romano stressed that the underground behavior of the water, chemical impurities and operating difficulties would defer any decision as to the commercial application of "fluid mining" of trona for several years.

New Mexico Potash

Construction work at the National Potash Co. mine near Carlsbad, N. Mex., is proceeding on schedule with production due to begin in February. Richard C. Wells, president of the company which is jointly owned by Freeport Sulphur Co. and Pittsburgh Consolidation Coal Co., said that the two mining shafts are down to the ore level, the 21-mile water pipe line is in operation, and the refinery and other facilities are nearing completion.

The \$19,000,000 project will have an annual capacity of 400,000 tons of high grade muriate of potash. The company will offer fertilizer manufacturers a granular product of minus 10 plus 28 mesh and a standard product of minus 28 plus 48 mesh.

Expands into Uranium

Twin Star Industries, after 35 years activity in the lignite field in North Dakota, has expanded mining operations to include uranium in the four-corners area near Monticello, Utah.

The operation, known as the Lode-star Mine, has been reequipped and additional shafts now being completed promise to substantially increase ore tonnage.

Valuation Engineer

The United States Civil Service Commission announces that an examination is now open for Valuation Engineer positions in the field of Mining, paying \$4,480 to \$7,570 a year. Most of the positions are with the Bureau of Land Management of the Department of the Interior located in the far Western States and in Alaska.

Applicants must have had appropriate education or experience. Full information regarding the requirements may be obtained at many post offices throughout the country or from the U. S. Civil Service Commission, Washington 25, D. C.

Applications will be accepted by the Northwest Board of U. S. Civil Service Examiners, Department of the Interior, 1001 N. E. Lloyd Blvd., P. O. Box 3537, Portland 8, Oreg., until further notice.

Hecla Exploration

Hecla Mining Co. has signed an agreement with Uranium Mines, Inc. of Wallace, Idaho, covering exploration of the latter firm's Tucker Flat and Big Flat properties in the Big Indian District of San Juan County, Utah. Hecla will spot and drill 12 exploratory holes on the claims before March 1, 1958.

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Underwater Mill Tailings

Mill tailings dumped into Kootenay Lake, British Columbia, are now yielding zinc for Consolidated Mining & Smelting Co. The underwater mining operation is off-shore from Cominco's Bluebell mine at Riondel. The old mill tailings are at depths of 75 to 400 ft.

Inland Dredging Co. of Calgary, B. C., is recovering the shallower tailings with barge-mounted equipment. Air forced down casings returns the tailings up a center pipe. The tailings are treated at the Bluebell mill along with mine ore, and concentrates are shipped to Cominco's zinc plant at Trail, B. C.

The deeper deposits are expected to be raised with a clamshell mucking device.

Bingham Pit Contract

Utah Copper Division, Kennecott Copper Corp., has selected Utah Construction Co. as contractor on an \$8,000,000 ore haulage tunnel driving project at the Bingham open pit mine. F. C. Green, Utah Copper's assistant general manager, said the \$8,000,000 contract covers only the driving of the 18,000-ft tunnel. Cost of tracks, centralized traffic equipment, signals, locomotives and other material is expected to bring the over-all expenditures to nearly \$10,000,000.

Utah Construction plans to start driving the tunnel from its adit near the Copperton Yards immediately. Utah Copper management estimates it will take about three years to complete the tunnel, which will be known as the 5490-ft railroad tunnel. It will be 350 ft below the 5040-ft tunnel and will be concrete-lined.

Uranium Reduction Ownership

Hidden Splendor Mining Co., the uranium subsidiary of the Atlas Corp., is to acquire a 30 percent interest in the Uranium Reduction Co. Reduction mill near Moab, Utah, according to Atlas president, Floyd Odlum.

The mill, now nearing completion, is one of the country's largest and is situated close to the major Atlas uranium ore reserves.

Black Hills Maps

The U. S. Geological Survey has announced that preliminary geological and structure contour maps of the northern and western flanks of the Black Hills, Wyoming, Montana and South Dakota, have been released for public inspection. Material for them was compiled for the Raw Materials Division of the Atomic Energy Commission. There are two maps and a 9-page table, which has information on oil and gas wells drilled in that area prior to February 15, 1956. The



"My Buddy's gettin' th' sample assayed, so I just as well sign th' papers for this car."

maps and tables are on open file at 468 New Customs House, Denver, and in the office of the Geological Survey in Billings, Mont. No copies are available for distribution.

Expands Uranium Reserves

Vanadium Corp. of America has purchased a one-third interest in a group of 27 mining claims in the Long Park area of Colorado. W. C. Keeley, president, announced. The interest was purchased from T. C. Brammeier and Henry Brammeier, prospectors,

whose claims extend over a 550 acre area and are known as the Eagle Basin group.

Mr. Keeley said the purchase will give Vanadium additional uranium-vanadium ore reserves for operation of its nearby Naturita mill.

Vanadium also has completed arrangements to lease 42 mining claims on a royalty basis from Marysville Uranium Co. of Utah. These claims extend over 850 acres in the Marysville area of that State, east of properties now operated by Vanadium.

Coking Coal Record

Kaiser Steel Corp. has announced that a nine-month production record in output of coking coal from its Sunnyside mines was attained during the period ending March 31, 1956, during which time 1,075,763 tons of coal were mined.

"Substantial increase in production is a partial result of increased mechanization at the mine. Two continuous mining machines have been added in the past nine months, bringing the total in use to ten," the company reported. "New loading machines, shuttle cars and improvements to the electrical distribution system have added to over-all efficiency of operations."

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● For many years, Flood City has specialized in furnishing standard replacement parts from stock, and in manufacturing replacement parts for all types of centrifugal and plunger type mine pumps. Damage due to wear and acid can be repaired, and many of the features found on Flood City pumps can be incorporated into the pump when it is rebuilt in Flood City shops. Impellers and other parts can be furnished for any make or type, in any desired material.

FLOOD CITY ENGINEERING SERVICE

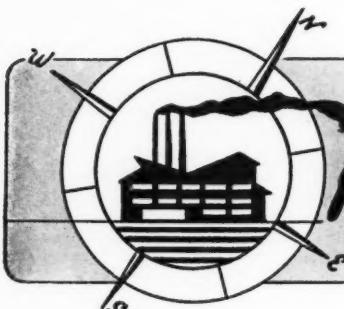
We will be pleased to have an engineer consult with you on any parts or pump rebuilding job on which you may desire a quotation . . . at no obligation to you.

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Manufacturers Forum

Cable Connection

INTERCHANGEABLE cable connections, which permit adding or removing cable sections in a few seconds, are now possible with the new Ohio Brass cap-screw cable connector,



according to Ohio Brass Co., Mansfield, Ohio. The device is intended for sectionalizing machine and feeder cables, as well as for switchboard and panel work.

Once the halves of the connector have been clamped to the cable ends, their tangs can be overlapped and locked together with two screw caps to form a connection. Interchangeability among the different connector sizes is provided by keeping the tangs uniform.

The O-B cable connector is available in five sizes for 4/0, 350,000 cm; 500,000 cm; 750,000 cm; and 1,000,000 cm cable.

Three-Boom Jumbo

COMPLETELY AIR OPERATED, this three-boom mining drill jumbo can reportedly operate at maximum efficiency in an area as large as 18-ft



wide and 10-ft high. Developed by the Thor Power Tool Co., it weighs 7800 lb completely equipped with drifter rock drills and mountings. The three booms can support either power feed, chain feed or air bar feed mountings.

It is claimed one man can operate the three booms without leaving his station at the air controls.

Bin Level Indicator

A ROTATING-PADDLE-TYPE bin level indicator, the Roto-Bin-Dicator is designed to indicate or control the level of any bulk material that will flow—from light aerated powders to heavy abrasive or lumpy materials. It is said to be particularly suited for application on bins under pressure or vacuum.

A low torque motor, located in an approved explosive-proof housing, ro-

Inquiries about new equipment appearing in Manufacturers Forum are welcomed.

For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

tates the paddle at slow speed. Material building up to the Roto-Bin-Dicator stops the rotating paddle and stalls the motor. As the motor stalls, the torque of the motor actuates a micro-switch which controls signal lights, horns, motors of conveyors or feeding machinery.

Write for catalog to The Bin-Dicator Co., 13946-216 Kercheval, Detroit 15, Mich.

Prospecting Instrument

FOUR SEPARATE PROSPECTING INSTRUMENTS combined in a single small case, the Uranium-Compass includes a Geiger, a probe which provides a circuit for a drill well probe, the directional Atomic Ray Compass which points toward the source of the gamma rays, and the Oratron circuit for deep ore detection.

Additional information may be obtained from OMCO, U. S. 93 and Las Palomas St., Kingman, Arizona.

Strong Base Anion Exchanger

A HIGH CAPACITY, porous type, strong base anion exchanger has been announced by National Aluminate Corp. The resin, called Nalcite SBR, Porous Grade, is expected to find use in the field of demineralization of water, as well as in processes such as sugar refining, uranium processing, plutonium recovery and similar applications. For technical literature and other information write to National Aluminate Corp., Dept. NR, 6216 West 66th Place, Chicago 38, Ill.

Rock Drill

A HIGH CAPACITY mining and tunneling rock drill and an automatically - retracted semi - integral pusher leg designed for simplified one-hand operation has been developed, according to Atlas Copco Eastern, Inc., 151 Linwood Ave., Paterson, N. J.

It is said that the new "Lion" can drill up to 90 ft in depth at an op-



tum rate of two fpm in granite. Controls for operating both the drill and the semi-integral pneumatic pusher are located on the Lion's back head. Opening the throttle simultaneously feeds air to the pusher to raise the drill, applies the flushing water and starts impact and rotation actions.

Producing 2000 blows per minute, the 65-lb drill operates at a pressure of 85 psi from a single one-in. air line.

The drill's rotation chuck is designed for $\frac{7}{8}$ -in. hexagon $4\frac{1}{4}$ -in. cored shanks. Standard rotation is on the return stroke but the Lion is convertible to downstroke rotation.

V-Belt Holder

A POCKET SIZE TOOL for applying alligator V-belt fasteners to open end V-belt has been announced by the Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Ill. This tool or holder as it is called by the manufacturer is made for B and C Section V-Belts, and is said to enable the user to make up V-belts of any length much quicker than heretofore was possible. Its low cost, according to the manufacturer, will enable the many small users of V-belts to keep a few feet of open-end V-belt plus the tool on hand to make fast emergency replacements, thus avoiding costly machine down time.

Pump

A HYDRAULIC PISTON pump has been announced by Dynex, Inc., 1500 South Muskego Ave., Milwaukee, Wis. The pump, Series PF-3006, has a 3000-psi maximum intermittent pressure and a rated pressure of 2000 psi. Pressures developed by the new piston pump is said to permit design engines to reduce the size of oil lines, fittings, valves and cylinders that make up a complete hydraulic system.

Fitting adapters are available with SAE straight threads or pipe threads. Shaft rotation can be in either direction and the unit can be mounted in any position. Displacement per revolution is 0.597 cu in. with 2600 rpm maximum and 8.6 maximum hydraulic

hp. The 25-lb unit will handle 2.8 gpm at 1200 rpm and 4.15 gpm at 1800 rpm.

Digger Teeth

REPLACEABLE digger teeth for shovel dippers, back hoe buckets, dragline buckets, clamshell buckets and loader buckets have been announced by Allied Steel & Tractor Products,



Inc., 7835 Broadway, Cleveland 5, Ohio.

A Bulldog Replaceable Digger Tooth has three parts. First, a universal well-on adapter that is attached by using the old tooth as a base. Second, a replaceable tip, and third, two positive lock pins for securing the tips to the adapter.

Bulldog Digger Teeth are attached by (1) burning off the old tooth to the adapter size, (2) welding on the adapter, and (3) securing the replaceable tip to the adapter by tapping the pins in place with a hammer.

Track-Mounted Wagon Drill



SELF-PROPELLED AND ONE-MAN OPERATED, the Chicago Pneumatic G-800 Traedril can mount a heavy-duty four-in. Drifter, or for soft-formation drilling, a CP-556 Rotauger.

Two Power Vane reversible tramping motors enable the G-800 to tow its own air compressor around the drilling area. Each track is independently powered by one of the two six-hp motors. Spring loaded "dead

man" type motor controls reportedly give instantaneous forward-back or pivot control, yet insure operator safety by returning to neutral when released. During actual drilling operations, the G-800 is uncoupled from the compressor and, within hose limits, moves from hole-to-hole.

For further information request SP-3192 of the Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.

Rubber Hose

A NEW CONSTRUCTION of suction hose has been announced by Goldstein-Schwartz, Rubber Hose Specialists, 10th and Tyler St., St. Louis 6, Mo. This hose is available as a stock item in sizes up to and including 12-in. inside diameter. Among the improved features claimed are: greater flexibility, two-wire construction giving the hose increased ruggedness, and lighter weight without sacrificing performance. The hose can be furnished either with ends enlarged to fit over standard pipe, or with standard pipe nipples attached.

Trenchliner

AN INCREASE IN DIGGING CAPACITY to ten-ft depth for the model 155 general utility Trenchliner has been announced by the Parsons Co., Newton, Iowa. The change does not affect the Trenchliner's range of digging widths of 16 through 26 in.



The ladder-type Trenchliner is 7 ft 4 in. high and 5 ft 4 in. wide. It is reportedly capable of producing 5.8 in. to 12.75 lineal ft of trench per minute. By changing a sprocket, a higher range of speeds is made available. The unit includes a hydraulic actuated hoist of the telescopic boom, reversible power-shift conveyor, self-cleaning tractor type crawlers and a range of bucket sizes. Either gas or diesel power is furnished with the 155 Trenchliner.

Automatic Thermal Control

AUTOMATIC MONITORING and accurate control of temperatures from minus 200° to 3000°F., in a broad variety of industrial and research applications, are provided by the Tipp-Tron controller, according to the Tipp Manufacturing Co., Tipp City, Ohio.

Depending on the model, the Tipp-Tron either prevents temperatures of equipment and processes from rising (high limit) or falling (low limit) past preset points. Double limit units also are available to maintain temperatures within specific and adjustable ranges.

The standard Tipp-Tron is available in either single or multi-meter models, with the latter providing control for virtually any number of individual temperature control points. Custom models also will be engineered and built to meet special heat control problems, according to the manufacturer.

Explosives

AVAILABLE IN 25 AND 50 LB CARTRIDGES five in. or greater in diameter, this new type of stripping and quarrying explosive consists of a basic cartridge charge of Amocol, Atlas' ammonium nitrate blasting agent, with a gelatin core. The gelatin core, which runs throughout the length of the cartridge, appears to promote the development of full ingredient strength, providing a much more efficient explosive.

Like conventional ammonium nitrate blasting agents, the new explosive, called Amocore, must be detonated with a high explosive primer. However, unlike conventional blasting agents, the continuous gelatin initiator is said to insure complete detonation and eliminate the need for intermediate high explosive booster charges placed at regular intervals throughout the explosives column in order to maintain detonation.

For further information write Explosives Division, Atlas Powder Co., Wilmington 99, Del.

Recording Potentiometer

THESE HIGH-SPEED SELF-BALANCING recording potentiometers can be used with analog-to-digital conversion devices. Designed to give full-scale traverse in 0.4 seconds, the electronic Dynamaster can be equipped with most of the standard digital read-out devices presently available. Ample torque is said to be available for operating retransmitting slide-wires, alarm contacts, and other auxiliary devices, without affecting the dynamic characteristics.

Round chart models are also available for such service, for use where prominent indication of the variables is needed while feeding digitized information to data handling equipment. Various pen speeds can be supplied, depending on the speed requirements and type of converter used.

For specific information, write to the Bristol Co., Waterbury 20, Conn.

Wire

A FILM-INSULATED solderable magnet wire, Analac, has been announced by Anaconda Wire & Cable Co.

This wire can be used exactly like Formvar or Plain Enamel, but without the necessity of removing the insulating film to make joints either during the winding process, or when attached to lead wires or to some other conductor.

If the user wishes, Analac's polyurethane film may be removed by mechanical and chemical means as well as by soldering.

Offered with both single and heavy grades of insulation, Analac has excellent abrasion resistance, according to Anaconda, and will withstand all

normal winding conditions. Dielectric loss, dielectric strength and dielectric constant all make it suitable for use in windings that generally are used on electronic devices.

Storage Batteries

RANGING IN SIZES SMALLER than a cigarette lighter and from $\frac{1}{2}$ to over 150 amp-hr capacity, this line of miniaturized nickel cadmium sintered plate storage batteries is manufactured by the Nickel Cadmium Battery Corp., 68 Pleasant St., Easthampton, Mass.

Some of the features claimed for these batteries are: virtually indestructible; capable of delivering momentary discharged currents as high as 25 times rated amp-hr capacity; useful capacity in temperatures ranging from minus 40°F. to plus 165°F.; and can be stored indefinitely in any state of charge without deterioration or fear of freezing.

According to the company, these batteries are proving valuable for engine starting in off the highway vehicles and other heavy motorized equipment.

Industrial Diesel Engines

AVAILABLE NATURALLY ASPIRED or supercharged, the Model 40 Superior Diesel Engines can reportedly operate exclusively on low-cost fuel. They are designed for use in heavy equipment like power shovels, as standby power for industrial plants, and mobile power for utilities. Portable engine generator sets range to 600-kw capacity.

The models are built as four-cycle, six or eight cylinder, vertical, in-line engines. Output of the engines range from 215 to 1025 hp.

Send inquiries to Harry Clark, advertising manager, White Diesel Engine Division, White Motor Co., Springfield, Ohio.

Cutter Wheel

CLAIMED TO BE HARDER and more durable, the Beaver Black Magic Honed Edge Cutter Wheel is manufactured by Beaver Pipe Tools, Inc., Warren, Ohio. It fits all standard-make No. 2 pipe cutters and pipe machine wheel cutoffs.

Giant Tractor-Trailer



CLAIMED TO BE THE WORLD'S LARGEST bottom dump hopper trailer, this 70-ton unit can carry 95 cu yd of coal struck or 100 cu yd heaped. Designed and manufactured by the Marion Metal Products Co., the trailer is 47 ft 4 in. long, 12 ft wide, and 13 ft 6 in. high.

The trailer is powered by a Model 803 Kenworth tractor designed and built by the Kenworth Motor Truck Co., of Seattle, Wash. The 400 hp diesel tractor is 11 ft 6 in. wide and 12 ft 5 in. high.

Weighing 98,620 lb empty, the entire unit will scale 238,620 lb when loaded with coal.

Kenworth's 803 tractor, with a V-12 diesel engine, torque converter and semi-automatic transmission, also

features power steering for driving ease. It is reported to be the largest two-axle, standard production model offered to the public.

The trailer is unloaded through two long hopper doors at the bottom, each measuring 26 by 2 ft, which open by gravity and are closed by air. Side panels on the trailer are fabricated of eight-gauge high tensile steel.

Tires on the big vehicle are 18.00 by 33 in., 32-ply nylon and are nearly six ft in diameter.

Charleston Truck and Trailer Service of Charleston, W. Va., representing both the Kenworth and Marion Metal lines of equipment in that area, sold the big truck to the Beckley Coal and Coke Co., in Nicholas County, W. Va.

Tractor-Shovels

TWO NEW FOUR-WHEEL-DRIVE, pneumatic-tired Payloader tractor-shovels have been announced by The Frank G. Hough Co., 846 Seventh Ave., Libertyville, Ill. These are the model HH with a payload capacity of 1 1/4 cu yd and 1 1/2 cu yd struck, and the model HU with a payload capacity of 1 1/2 cu yd and one cu yd struck.

Both units include the Hough Pay-



omatic power-shift transmission. Features claimed are power-steering, power brakes (on all four wheels), power-shift and a hydraulic system load-shock-absorber.

Boom-arm design which permits "pry-out" of the load and the bucket action which provides 40° tip-back of the load at ground level are said to be exclusive Payloader features in the pneumatic-tire tractor-shovel field.

Discharge Varistor Assembly

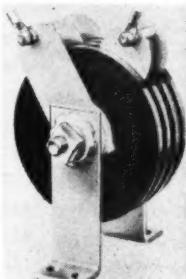
SUITABLY MOUNTED for direct installation in electrical circuits, a new Thyrite discharge varistor assembly has been announced by General Electric's Metallurgical Products Department, Detroit 32, Mich.

This addition to the General Electric line is designed for use in protecting motors, generators, lifting magnets, magnetic chucks,

solenoids, relays, large coils, etc., against high inductive surges resulting from sudden interruption of inductive currents.

Referred to as type 9RV6A assemblies, the new resistors are manufactured in ready-mounted groups of one to four varistors. Each varistor disk is six in. in diameter and 3/8-in. thick, with a one-in. central mounting hole.

Disk are bracket-mounted on a horizontal insulated bolt with a spring lock washer to provide contact pressure.



W. J. Klein has been appointed vice-president and director of sales, and W. L. Voegeli has been appointed general sales manager, Tractor Group, Allis-Chalmers Mfg. Co. Klein has been vice-president and general sales manager, Tractor Group, while Voegeli has been assistant director of engineering.

R. F. Knobloch has been appointed mid-western belting sales engineer for the conveyor and elevator belting department of United States Rubber Co. Knobloch was previously a sales engineer in the Passaic, N. J., office of the belting department. His headquarters will be in Chicago.

Richard G. Schaal has been appointed manager of the Mine Hoist Department of the Mine, Crusher and

Process Machinery Division, Nordberg Manufacturing Co., according to D. A. Cheyette, division vice-president. Schaal had been with the Cleveland-Cliffs Iron Co. for nine years prior to joining Nordberg.



Richard G. Schaal

For the past seven years he was chief mechanical engineer for the company's mines in Northern Michigan. He succeeds the late Ted C. Wiedenholt as manager of the Mine Hoist Department. John F. Foxx continues as chief engineer of the department.

C. J. Hawkes retired September 30 as Seattle Branch Engineer for The Electric Storage Battery Company's Exide Industrial Division.

George Leonard Nicholls will head sales and engineering activity in Seattle. As before, the territory will include Alaska, Oregon and Washington and also parts of Idaho and Montana adjacent. Resident sales-service engineers will be located in Portland and Spokane.

Link-Belt Co. has moved its Cleveland office to larger quarters in a new building at 3592 Lee Road, Cleveland 20, Ohio.

Macwhyte Co. has announced that Russell J. Whyte has been appointed field sales manager for the company. Whyte for the past 12 years has been a district factory representative in California, and prior to this was employed by Macwhyte Co. in product engineering work.

— Announcements —

Joy Manufacturing Co. has announced significant changes in the company's organization structure which involve the establishment of three new general management positions at the vice presidential level.

Hugo C. Nyquist has been named to the newly created post of vice-



H. C. Nyquist



J. A. Drain

president and general manager of the firm's Coal Machinery Division. Similar appointments were made in Joy's Mining and Construction Division where James A. Drain was named vice-president and general manager and in the Industrial Division which will be headed by Louis G. Helmick.

CATALOGS & BULLETINS

INDUSTRIAL HOSE AND FITTINGS. *Aeroquip Corp., Jackson, Mich.* Prepared for use in ordering Aeroquip parts, Bulletin No. 174 contains information on the company's standard industrial products and is designed primarily for use in the replacement field. Catalog lists hose, fittings, socketless kits and self-sealing couplings.

SIX YUBA DREDGES. *Yuba Consolidated Gold Fields, 351 California St., San Francisco 4, Calif.* This brochure illustrates and discusses six Yuba dredges that are available for purchase or lease.

INDUSTRIAL DIAMOND PRODUCTS. *Diamond Tool Research Co., Inc., 380 Second Ave., New York 10, N. Y.* With pictures, tables and a few words catalog No. 5 tells a good deal about diamond dressing and trueing tools, cutting and boring tools, powder, compound, and plated mandrels.

SCRAPERS AND DIESEL CRAWLER TRACTORS. *Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.* Booklet CR-585-F gives information on International Harvester's new Model 75 scraper. Booklets CR-491-F, CR-490-F, CR-489-F and CR-488-F describe the company's TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors respectively.

SHAFTER ROLLER BEARINGS. *Chain Belt Co., Milwaukee 1, Wis.* This 72-page catalog on Shafter Self-Aligning Roller Bearings contains specification and data on all models of Shafter units. It

(Continued next page)

(Continued from page 143)

describes the Shafer Self-Aligning principle of concave rollers running between convex raceway, the Shafer Micro-Lock Adjustment, and Shafer "Z" Seal. Catalog 55 also includes completely revised engineering data, new load rating tables, and an exploded view for parts identification.

MOVABLES OR END-DUMP P TRUCKS? C d D Div., Yuba Manufacturing Co., Perkins, Calif. Four-page folder compares end-dump trucks and positive-ejection Movables on 11 different points and is liberally illustrated with on-the-job action photos.

AIR HOSE FITTINGS. Le-Hi Division, Hose Accessories Co., 2700 No. 17th St., Philadelphia 32, Pa. Bulletin No. 110 describes and illustrates Le-Hi air hose fittings for mining, tunneling, contracting, quarrying, construction and in industry wherever compressed air is utilized. Complete information on sizes and part numbers are included.

STORAGE BATTERIES. Nickel Cadmium Battery Corp., 70 Pleasant St., Easthampton, Mass. Two bulletins describe the Nicad pocket plate nickel cadmium storage batteries, showing economic advantages and giving tabular data for various applications. Bulletin No. 334 covers control and standby batteries for switchgear, standby power and emergency lighting. Bulletin No. 168 discusses batteries for starting heavy-duty gas, gasoline and diesel engines, operating fire pumps, standby generators and remote power sources.

WELL WATER SYSTEMS, PUMPS, DRILLING. Public Relations Dept., Layne & Bowler, Inc., Memphis, Tenn. Bulletin No. 100 not only covers Layne water well systems, but such subjects as Layne oil and water lubricated Vertical Turbine Pumps, special water well drilling, service work, shutter screens, irrigation wells and pumps, water and well treatment for rehabilitating water sources and other phases of water development for industry and municipalities.

HORIZONTAL ROTARY FILTER. Dorr-Oliver Inc., Barry Place, Stamford, Conn. Bulletin No. 7201, "The Oliver Horizontal Rotary Filter", describes the features, design, operation, sizes and capacities of this continuous vacuum-type horizontal filter. Also included are a typical two-stage washing flowsheet and photographs illustrating the filter and its component parts.

OFF-HIGHWAY TRUCK. Construction Equipment Division, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Booklet CR-495-F describes the 24-ton model 95 and the 18-ton model 65 Payhaulers. Photographs and drawings illustrate the trucks.

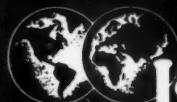
DRY GRINDING MILLS. Hardinge Co., Inc., 240 Arch St., York, Pa. Bulletin 17-C discusses the proper application and selection of Conical Mills, Tricone Mills, Cascade Mills, Rod Mills, Tube Mills and Disc Roll Mills for dry grinding problems. It also describes various air classifying arrangements and shows a number of plant flow sheets. Mill auxiliaries, such as feeders and electronic controls, are also covered. Specifications for a number of Hardinge dry grinding mills are given, plus grinding performance data for a large variety of materials.

FACTS. Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis. "Facts" describes Allis-Chalmers crawler tractors, tractor shovels, motor scrapers, pull-type scrapers and motor graders. Dealer services are noted.

WIRE ROPE ASSEMBLIES. Macwhyte Co., Public Relations Dept., Kenosha, Wis. This publication is a catalog of many swaged wire rope assemblies. These assemblies consist of a length of preformed wire rope with a terminal attached to one or both ends. Each end can be a different terminal fitting such as a threaded stud, oval eye, pin eye, clevis, hook, fork, turnbuckle, etc. Dimensions, drawings, capacities and sizes of both terminals and wire rope are given. Catalog 5601 is called, "Industrial Standards Macwhyte 'Safe-Lock' Wire Rope Assemblies."

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